VOL. 23, NO. 8
ISSN: 1541-9576
PERIODICALS
6200 Aurora Avenue•Suite 200W
Des Moines, Iowa•USA•50322-2864

FOOD PROTECTION TRENDS

SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

AUGUST 2003

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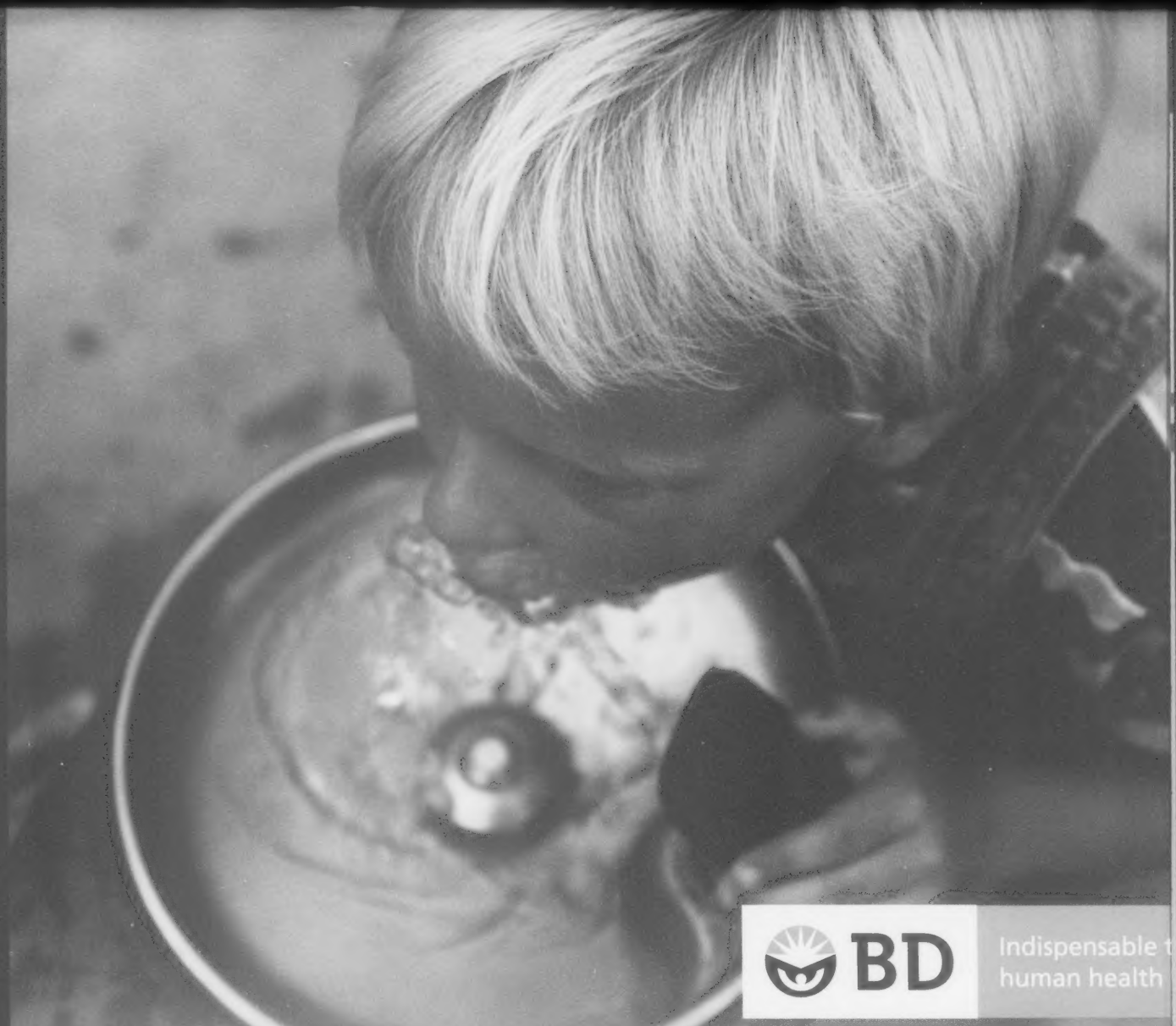

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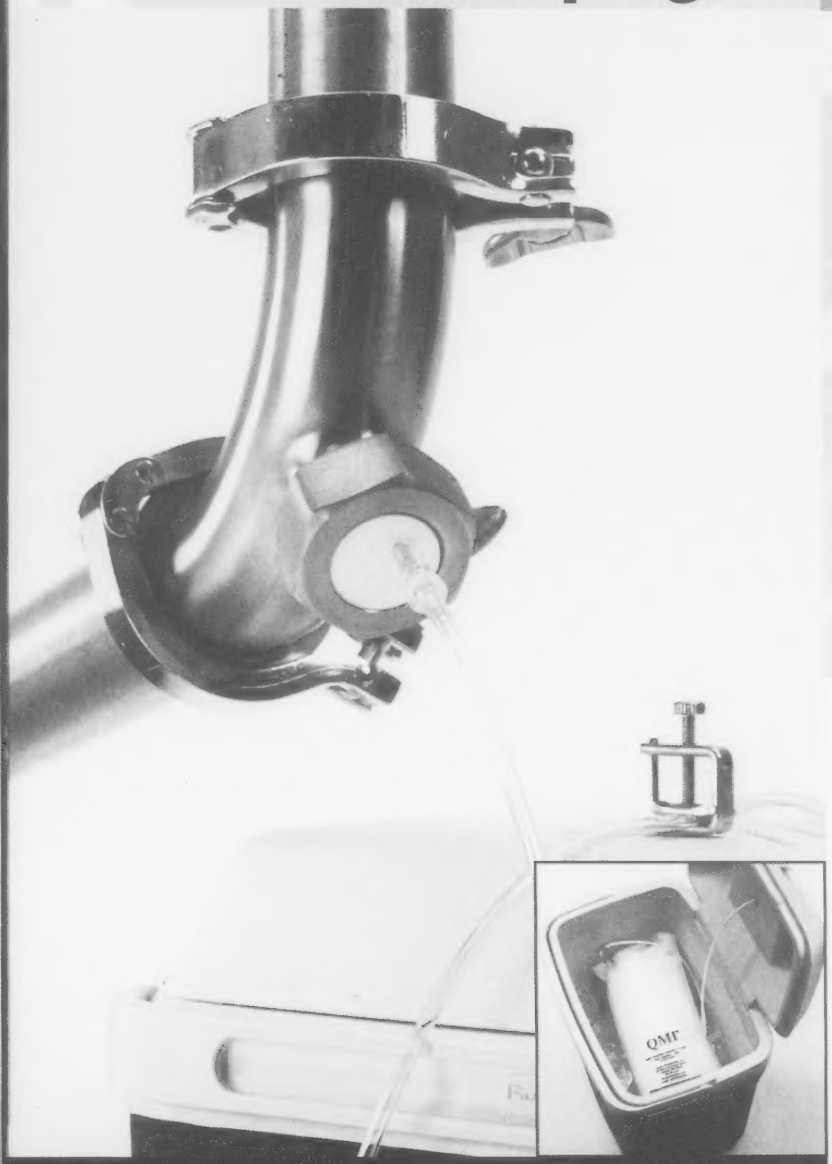

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SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

Food Protection Trends (ISSN-1541-9576) is published monthly beginning with the January number by the International Association for Food Protection, 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA. Each volume comprises 12 numbers. Printed by Heuss Printing, Inc., 911 N. Second Street, Ames, Iowa 50010, USA. Periodical Postage paid at Des Moines, Iowa 50318 and additional entry offices.

Manuscripts: Correspondence regarding manuscripts should be addressed to Donna A. Bahun, Production Editor, International Association for Food Protection.

News Releases, Updates, Coming Events and Cover Photos: Correspondence for these materials should be sent to Donna A. Bahun, Production Editor, International Association for Food Protection.

"Instructions for Authors" may be obtained from our Web site at www.foodprotection.org or from Donna A. Bahun, Production Editor, International Association for Food Protection.

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Business Matters: Correspondence regarding business matters should be addressed to Lisa K. Hovey, Managing Editor, International Association for Food Protection.

Membership Dues: Membership in the Association is available to individuals. Dues include a 12-month subscription to ***Food Protection Trends*** at a rate of $95.00 US, $110.00 Canada/Mexico, and $125.00 International. Dues including ***Food Protection Trends*** and the ***Journal of Food Protection*** are $165.00 US, $200.00 Canada/Mexico, and $245.00 International. Student memberships are available with verification of student status. Student rates are $47.50 US, $62.50 Canada/Mexico, and $77.50 International for ***Food Protection Trends***; $47.50 US, $67.50 Canada/Mexico, and $97.50 International for ***Journal of Food Protection***; and $82.50 US, $117.50 Canada/Mexico, and $162.50 International for ***Food Protection Trends*** and ***Journal of Food Protection***. All membership dues include shipping and handling. No cancellations accepted. Correspondence regarding changes of address and dues must be sent to Julie A. Cattanach, Membership Services, International Association for Food Protection.

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Subscription Rates: ***Food Protection Trends*** is available by subscription for $220.00 US, $235.00 Canada/Mexico, and $250.00 International. Single issues are available for $26.00 US and $35.00 all other countries. All rates include shipping and handling. No cancellations accepted. For more information contact Julie A. Cattanach, Membership Services, International Association for Food Protection.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days outside US.

Postmaster: Send address changes to ***Food Protection Trends***, 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA.

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"THOUGHTS FROM THE PRESIDENT

By ANNA M. LAMMERDING
PRESIDENT

"I encourage all members to make a special contribution to the Foundation Fund"

This is my last editorial as President of our Association. I know. I am turning over the reins to very capable leadership as Paul Hall comes in as the new President, with the support of our Executive Board members. I also welcome Frank Yiannas, Incoming Secretary, and look forward to working with him during this next year.

I write this column at the end of June 2003. With sadness, this month we lost a good friend, Harry Haverland. However, for those of us fortunate enough to have known Harry, we will always have good memories.

The year was 1998 in Nashville. I was honored by being presented with a special IAFP award, the Harry Haverland Citation Award and Harry was on hand to present it. I was somewhat nervous about the event (especially being the first female to win it… tsk, tsk…), and inadvertently thanked "Harvey" Haverland! Nevertheless, he graciously laughed and still made me feel good about it all.

That was also the year Harry started the Annual Meeting Silent Auction to raise money for the IAFP Foundation Fund. Even in that first year, contributions for the auction came in from many affiliates as well as individuals. I was enthusiastic to support the auction, and put in several bids for several items. My intention was simply to get the bids going up; after all, this is a charitable event to raise money for very good causes! Well, in the end, I brought home most of that which I bid on… my suitcase bulged! Since then, I try to restrict my enthusiasm during the bidding process.

The Foundation Fund was Harry's special project, and he took every opportunity to encourage contributions. In particular, the Florida affiliate rises to the challenge with imagination. It would be my guess that Harry waited with great anticipation for the annual business meeting, to see what FAFP would come up with as they presented their check. One year it was a large botched ballot, with the infamous "chads" representing the vote of the Florida members to make the donation; the next year Harry was gowned and masked to accept an envelope that seemed to contain white powder. He also was grateful to Paul Hall and Kraft Foods for issuing the "corporate challenge" to other companies to increase donations to the Fund.

We will miss Harry, his sense of humor, his commitment, and his steadfast support for our association. I would like to express my sympathies to his wife Helen, and daughters Alice and Kathy. IAFP 2003 in New Orleans is dedicated to Harry's memory. In further honoring this man, I encourage our members to make a special contribution to the Foundation Fund to continue Harry's work.

The past year has been a great experience, and I extend my appreciation to all of you who support this Association in one capacity or another. We have a great office team in Des Moines, and I thank each one of them for making our jobs on the Executive Board run smoothly. I also want to thank the affiliates that take advantage of our "speaker's program" by inviting Board members to participate in your educational programs. It's been a pleasure to see the activities at a local level, and the high calibre of these meetings.

IAFP continues to grow and we are beginning to really develop our network around the globe. I encourage our international members and affiliates to be active in IAFP, either at association level and participating in various groups and events at our annual meetings, or at a local level by organizing educational sessions and supporting local students to attend the annual meetings.

See you all in New Orleans!

IT'S A FACT

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See page 675 of this issue for additional information.

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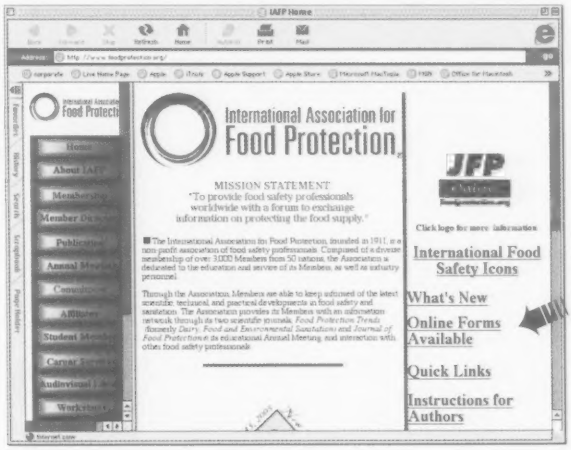
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"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR

By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"We are a group of individuals who come together to help produce the leading food safety meeting in the world!"

Summer is a busy time for most, but it is an especially busy time for IAFP. May and June brings warmer temperatures, green grass, leaves on the trees and lots and lots of work for our Members, Board and staff! By July, the time starts closing in and there are only weeks to go until Annual Meeting starts. Registration and hotel reservation cut-off deadlines pass and we know our time is near.

We have been very fortunate over the past years to see a steady growth in the number of attendees and exhibitors at the IAFP Annual Meetings. Although this creates more work and a few new problems for us here at the office, these are great problems to have to deal with. We would much rather deal with growth problems than the opposite!

An example of our growth can be seen in the number of attendees. This year we expect 1,450 to 1,500 attendees. It was just six short years ago when we first broke 1,000 attendees. Think of what that means in terms of our staff processing registrations. In comparison, the workload increased by one-half but our staff size remained the same. We had to find more efficient ways to process registrations with the same number of people in order to keep up. The IAFP Web site and online registration has helped by making our registration process flow smoothly.

Why do you think the attendance has grown by 50% in 6 years? We think we have the answer, "because ours is the best meeting for food science and food safety, hands down!" This is evidenced by the number of symposium proposals (46) and technical papers (426) received this past year. We will have more than 500 presentations at IAFP 2003 in comparison to half that many only three or four years ago. We now have five concurrent sessions compared to three just four years ago. The number of presenters has significantly increased over the past few years and each presenter must be communicated with at least three times prior to their presentation. Again, this essentially doubled the workload in this area and all the while our staff size remained the same. (Are you seeing where I am going yet?)

Since the number of presentations has grown, the Program and Abstract Book of course had to follow this same trend. In 1999, our Program Book was 116 pages; this year there are 236 pages! It is easy to see that this is two times as many pages and easily twice the work! Yes, you guessed it; our staff size remained the same.

Another area of fantastic growth has been in our exhibit hall and sponsorships. In this year of hard economic conditions, we were able to improve our sponsorship monies by 50% over the amount raised in 2002 and increase our exhibitors by 10 over last year. This was welcome news to us in June and July when preparing for the 90th Annual Meeting. We are indeed fortunate to receive the support of the leading companies involved in providing a safe food supply to the world's consumers! One last time, during this growth, our staff size remained the same.

What I really want to say here is, "a huge thank you to the IAFP staff for all of your hard work and dedication to doing a great job in all that you do". We have the best staff a director could ever wish to work with! Our staff of 10 gives 110% to prepare for the Annual Meeting because we know what it means to our Members, our exhibitors and to our attendees. It is the one place you can go to gain knowledge of new products and services, learn about the latest research and to meet new friends who could lead you to new discoveries or help solve problems that you might encounter later in your career.

The IAFP staff recognizes the importance of what we do and we enjoy the working relationships with

our members. We are a group of individuals who come together to help produce the "leading food safety meeting in the world!" Sure, it takes a lot of work, but the pay off is knowing that we have done a job to the best of our abilities and that our work was appreciated.

To the IAFP staff — thanks for everything you do and the sacrifices you make!

I want to end this month with a short note about Harry Haverland. As Anna Lammerding mentioned in her column, Harry passed away in June of 2003. We will surely miss Harry and his unending enthusiasm and support for IAFP and the IAFP Foundation. Anna also pointed out that IAFP 2003 is dedicated to the memory of Harry. He was one fine gentleman and always willing to do whatever he could to help IAFP. Our thoughts are with his family.

ACTIONS FROM THE 3-A SSI STANDARDS COMMITTEE ANNUAL MEETING

The 3-A Sanitary Standards, Inc. (3-A SSI) Standards Committees held their Annual Meeting May 12-16 in Milwaukee, Wisconsin, to review 31 tentative 3-A Standards and Accepted Practices. The following were approved for publication and distribution with an effective date of November 16, 2003:

- 3-A Sanitary Standard for Tubular Heat Exchangers, Number 12-07
- 3-A Sanitary Standard for Farm Milk Cooling and Holding Tanks, Number 13-10
- 3-A Sanitary Standard for Blending Equipment, Number 35-01
- 3-A Sanitary Standard for Rotor-Stator Mixers, Number 36-01
- 3-A Sanitary Standard for Pneumatic Conveyors for Dry Products, Number 39-01
- 3-A Sanitary Standard for Bag Collectors, Number 40-03 (This standard includes an amendment that is accepted pending approval of test protocol. The issuance of this standard will be concurrent with approval of the test protocol
- 3-A Sanitary Standard for Cross Flow Membrane Modules, Number 45-01
- 3-A Sanitary Standard for Spray Cleaning Devices Intended to Remain in Place, Number 78-01
- 3-A Sanitary Standard for Closed Cheese Vats, Number 83-00 (new standard)
- 3-A Sanitary Standard for Personnel Access Ports for Wet Applications, Number 84-00 (new standard)
- 3-A Sanitary Standard for Double-Seat Mixproof Valves, Number 85-00. (New standard; the standard will be issued pending approval of a test protocol
- 3-A Accepted Practice for the Construction, Installation and Cleaning of Membrane Processing Systems, Number 610-01

For additional information on the 3-A Sanitary Standards, visit www.3-a.org or call 3-A SSI at 703.790.0295

Food Protection Trends, Vol. 23, No. 8, Pages 654-663
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International Association for Food Protection

Removal of *Listeria monocytogenes* and Poultry Soil-containing Biofilms Using Chemical Cleaning and Sanitizing Agents Under Static Conditions

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SUMMARY

Cleaning and sanitizing the food processing environment often involves the application of chemical agents in the form of foam or gel (viscous liquid or thin film) to avoid the use of high pressure sprays and hand scrubbing, which can facilitate the spread of pathogenic bacteria. In addition to being applied without the cleaning benefit of physical force, these agents are often applied without application of heat to ambient or cold surfaces. The objective of this research was to evaluate the effectiveness of cleaning and sanitizing chemicals in removing *Listeria monocytogenes* biofilms coated with soil of poultry origin and applied under static conditions without application of heat. Chemicals evaluated were alkaline and neutral cleaning compounds, as well as sodium hypochlorite, acidified sodium chlorite, peroxyacetic acid, peroxyacetic acid/octanoic acid mixture, and quaternary ammonium compound sanitizing agents. Biofilms were prepared by growing *L. monocytogenes* on stainless steel for 24 hours at 25°C. The biofilms were then coated with chicken serum albumin and rendered chicken fat. Chemical treatments were at room temperature (25°C) for 1 to 30 minutes, with selected treatments at 4°C. The alkali cleaning agent removed 99% of fat and 93% of protein within 30 minutes. The neutral cleaning agent was equally effective at removing fat but removed only 77% of protein. The alkali cleaning agent also effectively removed *L. monocytogenes* biofilm coated with protein, decreasing cell numbers on the surface by over 7 log cycles within 10 minutes. Acidified sodium chlorite and peracetic acid/octanoic acid mixture were the most effective sanitizers at killing *L. monocytogenes* biofilm coated with fat and protein, both reducing numbers by more than 5 log units within 1 min. A combination of 10 minute cleaning with alkali and 30 minute sanitizing with acidified sodium chlorite reduced *L. monocytogenes* to nearly undetectable levels (at 0.2 CFU/50 cm^2) and a greater than 7 log reduction. The combination of alkali cleaning (10 minutes) and use of either acidified sodium chlorite or peracetic acid/octanoic acid (10-minute exposure) were effective at inactivating the *L. monocytogenes* biofilm at 4°C, achieving > 6.0 and 5.3 log reductions, respectively. This research has demonstrated that processing plant environmental surfaces can be effectively cleaned and sanitized using static application of chemicals on surfaces ambient and cold temperatures.

A peer-reviewed article

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TABLE 1. Description of cleaning and sanitizing chemical preparations used in this study with recommended use level

Chemical agent	Product name[a]	Recommended usage level	Active ingredient (%) in commercial preparation
Acidified sodium chlorite	Oxxium 200 combined with Oxxium 300	2.0 ml/l (Oxxium 200)	Sodium chlorite (7.5%)
		11.7 ml/l (Oxxium 300)	Phosphoric acid (6%), organic acids (1–5%), and anionic surfactant (5–20%)
Quaternary ammonium compound	Quorum clear	2.0 ml/l	n-alkyl dimethyl benzyl ammonium chlorides (5%) and n-alkyl dimethyl ethylbenzyl ammonium chlorides (5%)
Peracetic + octanoic acid	Vortexx	1.3 ml/l	Acetic acid (24%), hydrogen peroxide (5–20%), peroxyacetic acid (1–5%), and octanoic acid (1–5%)
Peracetic acid	Oxonia active	2.0 ml/l	Acetic acid (8%), hydrogen peroxide (27.5%), and peroxyacetic acid (5.8%)
Sodium hypochlorite	Sodium hypochlorite	4 ml/l (to give 200 ppm)	Sodium hypochlorite (5%)
Alkaline cleaner	TFC green II	94 ml/l	Sodium hydroxide (10%), tallow bis (hydroxyethyl) amine oxide (5%), diethyleneglycol methyl ether (3%), propylene glycol monomethyl ether (3%), and dipropylene glycol methyl ether (3%)
Neutral cleaner	TFC pink	94 ml/l	Trimethyl tallowalkyl quaternary amonium chlorides (4%), potassium phosphate tribasic (5%), diethylene glycol methyl ether (3%) propylene glycol monomethyl ether (3%), dipropylene glycol methyl ether, surfactants (9%), and isopropyl alcohol (1%)

All chemicals, except sodium hypochlorite, were obtained from Ecolab, Inc., St. Paul, MN

INTRODUCTION

Listeria monocytogenes is a psychrotrophic pathogen that causes illness primarily in pregnant women and immune-compromised persons. Preventing foodborne listeriosis requires preventing recontamination of processed product, because the microorganism can grow at refrigeration temperature. Products commonly contaminated with *L. monocytogenes* include precooked processed meats, precooked refrigerated seafood, and precut, packaged vegetables.

Preventing contamination of precooked products with *L. monocytogenes* presents a difficult challenge for most processors. The pathogen enters the plant with raw product or personnel and then multiplies in the plant environment on wet surfaces. An important aspect of preventing *L. monocytogenes* contamination of ready-to-eat foods is controlling the presence of the pathogen in the processing plant environment. Such control requires adequate cleaning and disinfection of environmental and food contact surfaces. If microorganisms produce biofilms on these surfaces, the microorganisms become

TABLE 2. Protein and fat removed from stainless steel by static cleaning

Soil type	Cleaning Agent	10-min exposure		30-min exposure	
		Mean %[a]	Std. Deviation	Mean %	Std. Deviation
Protein	Alkaline	84	2.8	93	2.1
	Neutral	66	1.8	77	2.3
	Water	54	2.2	67	4.5
Fat	Alkaline	98	2.4	99	0.6
	Neutral	96	2.9	99	0.7
	Water	22	16	15	8.6

[a] N = 6 for protein data and N = 14 for fat data; coupons with 50 cm^2 of surface area were coated with 8 mg protein or 730 mg fat

TABLE 3. Removal of *Listeria monocytogenes* biofilm from stainless steel by static cleaning

	10-min exposure			30-min exposure		
Cleaning Agent	Mean CFU/50 cm^2	Standard Deviation	Log Reduction	Mean CFU/50cm^2	Standard Deviation	Log Reduction
Alkaline	1.85[a]	1.5	7.38	1.0	NC[b]	7.47
Neutral	1.35	1.0	7.55	1.0	0.5	7.49
Water	> 5,000	———[c]	< 2.0	> 5,000	———	< 2.0

[a]n = 6

[b]not calculated; each replication produced a plate with just one colony

[c]——— not meaningful due to results outside the detection range

TABLE 4. Removal of *Listeria monocytogenes* biofilm coated with protein[a] by static cleaning

	10-min exposure			30-min exposure		
Cleaner	Mean CFU/50 cm^2	Standard Deviation	Log Reduction	Mean CFU/50cm^2	Standard Deviation	Log Reduction
Alkaline	1.15[b]	0.5	7.50	1.5	1.0	7.45
Neutral	46	14	5.91	22.5	5.5	6.21
Water	> 5,000	———[c]	< 2.0	> 5,000	———	< 2.0

[a]Each 50 cm^2 coupon was coated with 8 mg protein after biofilm formation

[b]n = 6

[c]——— = not meaningful due to results not within the detection range

TABLE 5. Inactivation of *Listeria monocytogenes* biofilm on stainless steel by static application of chemical sanitizers at recommended usage concentration

Sanitizing agent	Time of exposure (min)								
	1			10			30		
	Mean[a] CFU/50 cm²	Std. Deviation	Log Reduction	Mean CFU/50 cm²	Std. Deviation	Log Reduction	Mean CFU/50 cm²	Std. Deviation	Log Reduction
Sodium hypochlorite	1.5	.5	7.45	.04	.04	7.37	3.0	3.0	7.25
Quaternary ammonium compound	3.0	.25	7.15	.04	.03	7.37	1.5	1.0	7.42
Acidified sodium chlorite	32	11.5	6.07	.55	.26	6.16	1.0	NC[b]	7.55
Peracetic + octanoic acid	67	35.5	5.81	1.97	.59	5.57	20	10	6.29
Peracetic acid	295	42	5.09	6.2	1.0	5.06	28.5	14	6.15
Water	> 5000	——[c]	< 2.0	> 5000	———	< 2.0	> 5000	———	< 2.0

[a] n = 6

[b] Not calculated; each replication produced plates with just one colony

[c] —— = not meaningful due to results not within the detection range

difficult to kill by application of chemical sanitizers *(1, 3, 4, 7)*.

Effective application of cleaning/sanitizing agents in food processing environments is limited by various considerations, such as the following: the need to limit aerosol production to avoid the spread of pathogens throughout the plant; cold surface and air temperatures; and relatively little use of manual labor. One approach that limits aerosol production and requires little labor is to apply chemical cleaning and sanitizing agents under static conditions so as to limit use of high pressure water or hand scrubbing. These chemicals can be applied as foams or viscous liquids. Application of viscous liquids may have an advantage over foaming because foams tend to drip from vertical surfaces, reducing contact time. Regardless of whether cleaning/sanitizing agents are applied as foam or viscous liquid, the chemical is expected to clean and/or sanitize the surface without addition of heat (possibly on a cold surface) or with little application of physical force (no manual scrubbing or flow turbulence), conditions considered a requirement for effective conventional cleaning.

The objective of this research was to evaluate various chemical sanitizing and cleaning agents for their ability to clean and sanitize stainless steel when applied under static conditions (no scrubbing or turbulence), without application of heat and in the presence of an organic load of poultry origin. *Listeria monocytogenes* was selected as the test microorganism.

MATERIALS AND METHODS

A description of the cleaning and sanitizing chemicals used in this study and the concentrations at which they were used are listed in Table 1. Sanitizing chemicals were employed at both the manufacturer's recommended use level and at one-half that level. The cleaning solutions were used at the level recommended for high soil loads.

Five strains of *Listeria monocytogenes* (G3990, Scott A, YM96, 12374, and G3982) were obtained

TABLE 6. Inactivation of *Listeria monocytogenes* biofilm on stainless steel by static application of chemical sanitizers at one half recommended usage concentration

Sanitizing agent	Time of exposure (min)								
	1			10			30		
	Mean[a] CFU/50 cm^2	Std. Deviation	Log Reduction	Mean CFU/50 cm^2	Std. Deviation	Log Reduction	Mean CFU/50 cm^2	Std. Deviation	Log Reduction
Sodium hypochlorite	8.5	9.0	6.87	3.0	5.5	7.32	5.5	2.5	6.87
Quaternary ammonium compound	3.5	1.0	7.05	3.0	2.0	7.14	2.5	2.0	7.24
Acidified sodium chlorite	44	13	5.93	51.5	36	5.92	6.0	3.5	6.85
Peracetic +octanoic acid	65	46	5.75	39	23	6.01	29	11	6.12
Peracetic acid	290	55	5.09	236	40.5	5.18	45.5	16.5	5.92

[a] n= 6

from the Center for Food Safety in Griffin, GA. Cultures were stored at -80°C. To prepare the inoculum, a bead from each culture was placed in a tube containing 10 ml of tryptic soy broth (TSB, Becton Dickson, Sparks, MD) and incubated for 24 hours at 32°C. One-tenth ml of this culture was then transferred to fresh TSB and incubated as before. After two transfers, 2 ml of culture was used to inoculate 200 ml of 10% TSB (containing 3 g of TSB dried medium/l). This was incubated at 25°C for 24 hours and was then used to prepare the biofilms.

Biofilms were produced on stainless steel (type 304, #4B finish) cut into 7 1/2 + × 11 cm coupons. The coupons were cleaned by immersion in 100 ml/l solution of Micro-90 Soap (International Products Corporation, Burlington, NJ) at 80°C for 1 hour of sonication in an ultrasonic bath, model 550 HT (VWR, Atlanta, GA). Coupons were then rinsed in deionized water, sonicated in 1.5% phosphoric acid solution at 80°C for 20 minutes, and again rinsed in deionized water. After the clean coupons were submerged in deionized water and sterilized by autoclaving, they were placed in a flat, sterile stainless steel pan (52 cm × 32 cm, with lid) and immersed in the 1 l combined inoculum of the five strains of *L. monocytogenes*. The stainless steel was then incubated with the *L. monocytogenes* cocktail for 4 hours at 25°C to allow attachment. The coupons were then rinsed with sterile 3.12 mM phosphate buffer (pH 7.2) to remove unattached cells. They were then again immersed in 1 L of 10% TSB and incubated at 25°C for 24 hours to allow biofilm growth. After incubation, the coupons were removed from the medium, rinsed with sterile phosphate buffer to remove unattached cells, and allowed to dry at room temperature. Biofilms for cold temperatures experiments were prepared in a similar manner except that a temperature of 12°C was used.

Biofilms were then coated with protein, fat or both, to more closely simulate processing plant soil. Protein was in the form of thawed chicken meat exudate (Fieldale Farms, Colbert, GA). A solution (0.8 ml) containing 8 mg protein/g was spread over the biofilm surface. The coupons were then incubated at 45°C for 30 minutes to fix the protein to the surface, and then allowed to dry at room temperature for approximately 1 hour. When protein and fat were both applied, a mixture (0.8 ml) containing 4 mg protein/g and 365 mg fat/g was spread over the biofilm surface.

Fat obtained as rendered chicken fat (Valley Fresh, Inc., Talmo, GA) was melted, and 0.8 ml, containing 730 mg fat/g, was spread over either the biofilm/protein soil or over

TABLE 7. Inactivation of *Listeria monocytogenes* biofilm coated with protein and fat by treatment with sanitizers under static conditions at the recommended usage concentration[a]

Sanitizer	Time of exposure (min) 1			10			30		
	Mean[a] CFU/50 cm²	Std. Deviation	Log Reduction	Mean CFU/cm²	Std. Deviation	Log Reduction	Mean CFU/cm²	Std. Deviation	Log Reduction
Sodium hypochlorite	198	560	4.27	1,060	405	4.56	142	41.5	5.41
Quaternary ammonium compound	685	350	4.78	104	172	5.56	32	8.5	6.06
Acidified sodium chlorite	61.5	16	5.76	17.5	5.5	6.32	41.5	28	6.16
Peracetic + octanoic acid	325	139	5.06	195	65	5.28	42	28	6.16
Peracetic acid	1240	433	4.48	950	296	4.59	196	32	5.26
Water	> 5000	—[c]	< 2	> 5000	—	< 2	> 5000	—	< 2

[a]Each coupon was coated with 4 mg protein and 365 mg fat

[b]n = 6

[c] —— = not meaningful due to results not within the detection range

biofilm soil and allowed to solidify at 4°C for 1 hour. The soiled coupons were then allowed to equilibrate to room temperature for approximately 1 hour.

Cleaning and sanitizing treatments of soiled coupons

Cleaning and sanitizing chemicals were prepared according to manufacturer instructions. Sufficient cleaning solution was applied to the soiled coupons to coat the surface completely. For sanitization, coupons were completely immersed in the sanitizing solution. Applications were either at room temperature (25°C) or at 4°C (for cold temperature experiments). After exposure, the coupons were rinsed free of cleaning solution with a gentle flow of sterile deionized water and then allowed to dry at room temperature. Control coupons were treated in a similar manner, with sterile distilled water substituted for cleaning solution.

Analysis of residual protein and fat

Fat and protein removed from the coupons by the cleaning treatment were determined for coupons having a single soil type (fat or protein), not for coupons with a combination of fat and protein. During the cleaning procedure, soap and rinse liquids were quantitatively recovered. Amounts recovered ranged from 30 ml to 58 ml per coupon. The protein concentration in the wash solution was determined using the Pierce BCA Protein Assay *(6)*. Positive controls consisted of soiled coupons cleaned with water. Negative controls consisted of unsoiled coupons cleaned with water and with cleaning solution. Removal of fat was determined by the difference in weight between soiled and cleaned coupons. Dried coupons were weighed before and after deposition of fat. After cleaning, the coupons were rinsed with deionized water, dried for 1 hour at room temperature and again weighed. The percent fat removed was then calculated. Fat removal data was based on 7 replications, with each replication consisting of duplicate analysis.

Enumeration of surviving L. monocytogenes

L. monocytogenes surviving the cleaning/sanitizing treatments were determined by overlaying an agar

TABLE 8. Comparison of sanitizer treatments for inactivation of *Listeria monocytogenes* biofilm coated with protein and fat.[a] Statistical analysis on combined data for all treatment times and at recommended usage level

Sanitizer Treatment	Mean Log Reduction[b]
Acidified sodium chlorite	6.02[A]
Peracetic + octanoic acid	5.50[B]
Quaternary ammonium compound	5.47[B]
Peracetic acid	4.78[C]
Sodium hypochlorite	4.75[C]
Water	<2.0[D]

[a]Each biofilm was coated with 365 mg fat and 4 mg protein

[b]Mean separation by Duncan's Multiple Range Test; means with different superscripts (A, B, C, D) significantly different at $P = 0.05$

medium directly on the cleaned coupons. The agar medium consisted of trypticase soy agar with 1 ml *Listeria* selective supplement (Oxoid Ltd, Basingstoke, Hampshire, England) added per 100 ml. Treated coupons were placed in sterile 150 mm plastic petri dishes. A sterile 50 cm^2 template was placed on each coupon to contain the liquid medium. The tempered medium (10 ml at 47°C) was then poured over the coupon within the template. After the medium had set, the templates were removed and the coupons were incubated (in covered petri dishes) at 37°C. Yellow colonies on plates were enumerated after 24 and 48 hours of incubation, with the greater number being reported. Counts were recorded as CFU *Listeria*/50 cm^2. An uninoculated coupon was included in each experiment to check for contaminants that might appear similar to *Listeria* colonies. No such contaminants were observed.

Viable cells in the untreated biofilms could not be enumerated using the agar overlay method applied to treated coupons because cell numbers were too great. Rather, cells were removed from the biofilm-containing coupons by scraping with a Teflon policeman (VWR, Suwanee, GA) as described by Frank and Koffi *(3)*. The total volume of the scraping and rinsing buffer was brought to 100 ml. The rinse solution and appropriate dilutions were plated onto Tryptic Soy Agar (Becton Dickson, Sparks, MD) with *Listeria* Selective Supplement (Oxoid, England) using an Autoplate 4000 spiral plating device (Spiral Biotech, Bethesda, MD). Inoculated plates were incubated at 37°C for 18 hours. Colonies were then counted and CFU/cm^2 was calculated according to the spiral plater instruction manual. The $\log_{10}$ of this result was used to calculate the log reduction for each treatment.

Data analysis

Experiments were replicated 3 times unless otherwise indicated. Each replication consisted of duplicate analyses. The GLM procedure of the Statistical Analysis System (SAS Institute, Cary, NC) was used for data analysis.

RESULTS

Removal of fat and protein

Static application of alkali cleaning agent at room temperature removed 98 and 99% of fat, and 84 and 93% of protein, after 10 and 30 minutes of exposure, respectively (Table 2). The neutral cleaning agent was effective at removing fat, but not at removing protein (77% removed within 30 minutes). These results indicate that alkali cleaning agents effectively remove protein and fat-based food soils in static cleaning operations when they are applied at recommended concentrations and have sufficient contact time with the soiled surface.

Removal of *L. monocytogenes* biofilm by cleaning agents

Alkali and neutral cleaning agents removed *L. monocytogenes* from the stainless steel, providing a greater than 7 log reduction within 10 minutes (Table 3), although detectable, *Listeria* still remained on the surface. When the biofilms were coated with protein, the alkali cleaner was still effective at removing or inactivating the *L. monocytogenes*, whereas the neutral cleaner exhibited both decreased effectiveness and increased variation (Table 4). This reflects the ability of the alkali cleaner to remove the protein coating (Table 2) and therefore reach the underlying *Listeria* biofilm. Alkali cleaning agents have little ability to kill *Listeria (8)*, so removal of the pathogen from the surface should not be considered equivalent to sanitizer treatments that kill both suspended and attached cells.

Inactivation of *L. monocytogenes* biofilm by sanitizing agents

Table 5 shows data on viable *L. monocytogenes* populations remaining on the surface after static application of various sanitizing agents to the (uncleaned) biofilms with no added organic load. All sanitizers tested were effective at reducing populations *L. monocytogenes* by more than 5 log units, the generally accepted standard for effective sanitation. Quaternary ammonium compound and hypochlorite were the most effective at rapidly inactivating (1 minute exposure time) biofilms

TABLE 9. Inactivation of *Listeria monocytogenes* biofilm coated with protein and fat by treatment with sanitizers under static conditions at one half the recommended usage concentration[a]

Sanitizing agent	Time of exposure (min)								
	1			10			30		
	Mean[a] CFU/50 cm^2	Std. Deviation	Log Reduction	Mean CFU/50 cm^2	Std. Deviation	Log Reduction	Mean CFU/50 cm^2	Std. Deviation	Log Reduction
Sodium hypochlorite	1400	560	4.43	1,640	345	4.34	128	29	5.39
Quaternary ammonium sanitizer	660	340	4.78	230	235	5.40	36.5	22	6.07
Acidified sodium chlorite	310	325	5.21	24.5	10	6.18	64.5	19.5	5.76
Peracetic + octanoic acid	560	405	4.90	340	158	5.05	164	82	5.37
Peracetic acid	1160	390	4.50	1060	292	4.54	1050	322	4.55

[a]Each coupon was coated with 4 mg protein and 365 mg fat

[b]n=6

TABLE 10. Removal and inactivation of *Listeria monocytogenes* biofilm coated with protein and fat by using static cleaning for 10 min followed by sanitation with 2 ml/l of acidified sodium chlorite[a]

Cleaning agent	Exposure to sanitizer					
	10-min			30-min		
	Mean[b] CFU/50 cm^2	Standard Deviation	Log Reduction	Mean CFU/50 cm^2	Standard Deviation	Log Reduction
Alkaline cleaner	12	5.5	6.5	.165	.50	7.6
Neutral cleaner	1,600	451	4.6	600	141	4.8

[a]Each coupon coated with 4 mg protein and 365 mg fat

[b]n = 6

under these conditions; however, the effectiveness of acidified sodium chlorite increased substantially with increase exposure time (from 6.07 to 7.55 log reduction), probably due to the time needed for chlorine dioxide to be generated and penetrate the biofilm.

All sanitizer chemicals were effective at inactivating *L. monocytogenes* even when employed at one-half the recommended usage level (Table 6). All sanitizers achieved a greater than 5 log reduction of viable *Listeria* on the treated surfaces with only 1 minute of exposure, and a 6 log reduction or greater after 30 minutes of exposure. Quaternary am-

TABLE 11. Efficacy of combined cleaning/sanitizer treatment at 4°C for the removal and inactivation of *Listeria monocytogenes* biofilm coated with protein and fat.[a] Cleaning treatment was with alkali cleaning solution for 10-min followed by treatment with sanitizing agent for 10-min

	Mean CFU (per 50 cm^2) [b]	Log reduction
Quaternary ammonium compound	63.2[a]	4.0
Peracetic acid + octanoic acid	4.0[b]	5.3
Acidified sodium chlorite	< 1.7[c]	>6.0

[a]Each coupon coated with 365 mg fat and 4 mg protein

[b]Figures with different superscript letters (a, b) differed significantly ($P = 0.05$); data for acidified sodium chlorite was not included in the statistical analysis because of results below the detection limit of 1.7 CFU per 50 cm^2

[c] One of the six replications produced one colony; the other five replications produced no colonies

monium compound was the most effective sanitizer tested when used at one-half the recommended level with low organic load and also exhibited lower standard deviations than the other treatments.

With an organic load of fat and protein, all sanitizers exhibited reduced effectiveness; only the acidified sodium chlorite and peracetic acid/octanoic acid sanitizers achieved greater than a 5-log reduction after a 1-min treatment (Table 7). Sodium chlorite produced the most consistent microbial inactivation, as indicated by the low standard deviation. After 10-min of exposure, the quaternary ammonium compound also attained a 5-log reduction, but with a high standard deviation. All sanitizing agents tested achieved a 5-log reduction when a 30-min exposure was used, with quaternary ammonium compound exhibiting the most consistent results. When combined data for all times is analyzed by ANOVA (Table 8), acidified sodium chlorite is found to be the most effective sanitizer in the presence of fat and protein, with quaternary ammonium compound and peracetic/octanoic acid nearly as effective.

When sanitizing agents were applied at one-half the recommended levels in the presence of an organic load, the acidified sodium chlorite was the most effective sanitizer after 1 and 10 min of exposure, with the quaternary ammonium compound most effective after 30 min (Table 9). The peracetic acid was the least effective sanitizer at one-half recommended usage levels in the presence of an organic load. The relatively poor performance of peracetic acid against biofilms in the presence of organic load is interesting, as previous work indicated that this sanitizer was effective against biofilms with an organic load in the form of milk solids *(2)*, whereas another group working with multi-species biofilms found peracetic acid sanitizer relatively ineffective against *L. monocytogenes (5)*. An important aspect of this study that differs from previous work is the high amount of fat included in the organic challenge. Additional evidence for the significance of fat is that inclusion of the more hydrophobic octanoic acid in the peracid mixture increased the effectiveness of the mixture.

When cleaning and sanitizing are employed sequentially, using the alkali cleaner (10-minute exposure) and acidified sodium chlorite, *L. monocytogenes* is reduced to a nearly undetectable level of 0.165 CFU/50 cm^2 (a greater than 7 log reduction) after a 30-minute sanitizer exposure (Table 10). When a less effective cleaning agent (neutral cleaner) was used, over 100 times more *L. monocytogenes* survived the cleaning/sanitizing process. These data indicate the importance of effective cleaning in attaining control of *L. monocytogenes* on surfaces with an organic load.

Effectiveness of low temperature cleaning/sanitizing treatments

Biofilms of *L. monocytogenes* with organic load were cleaned with alkali for 10-min and then sanitized with selected chemicals for 10-min at a temperature of 4°C (Table 11). Acidified sodium chlorite was the most effective sanitizer and quaternary ammonium compound the least effective under these conditions. The peracetic acid/octanoic acid mixture was significantly more effective than the quaternary ammonium compound at cold temperature.

DISCUSSION

This study demonstrates that static cleaning and sanitizing procedures (no scrubbing or turbulence) often employed for stainless steel surfaces in food processing plants can be effective at controlling *L. mono-*

cytogenes in the presence of light organic loads. Cleaning with alkali and sanitizing with acidified sodium chlorite was the most effective combination for *Listeria* control of the combination tested at both ambient and refrigeration temperatures. Other sanitizing agents, including quaternary ammonium compound and peracetic acid/octanoic acid mixture, were also effective in the presence of organic loads. Although quaternary ammonium compound was less effective in the 4°C experiment, the exposure time was only 10 minutes, and quaternary ammonium compounds are known to maintain residual activity.

Although this study demonstrates the general effectiveness of static cleaning and sanitizing treatments, processing plants still may encounter survival of *Listeria* in the processing environment. This might arise from lack of sufficient contact time between the cleaning/sanitizing agent and the contaminated surface due to dripping of foam, lack of careful chemical application so that not all soiled areas are covered, use of sanitizing agents without first cleaning when a high organic load is present, or an organic load too high for the concentration of cleaning agent applied. The problem of insufficient contact time can be alleviated by using viscous cleaning agents (thin film preparations) that do not drip off vertical surfaces and adhere to the underside of horizontal surfaces. Additional employee training and supervision, and physical removal of gross amounts of organic matter before chemical cleaning, may also be necessary.

Data reported in this study indicate that if a plant can apply only one type of chemical for environmental sanitation, it should be an alkali cleaner, which was demonstrated to effectively remove (but not inactivate) *Listeria* biofilm in the presence of organic load. If a low organic load is expected, use of a sanitizing agent rather than alkali cleaner could be recommended. Environmental sites known to be at risk for harboring *Listeria* spp. should be treated with alkali and a sanitizing agent in sequence to ensure the highest degree of soil removal and microbial kill.

ACKNOWEDGMENTS

This research was supported by State and Hatch funds allocated to the Georgia Agricultural Experiment Stations, by the Georgia Food Processing Advisory Council and by the Center for Food Safety.

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Food Protection Trends, Vol. 23, No. 8, Pages 664-674
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International Association for Food Protection

Food as a Weapon

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SUMMARY

The use of food as a weapon has been practiced since antiquity. Assassination by poisoning food and wine is well documented in history and literature. Mass casualties because of spontaneous spoilage of grain and meat have been common, but attempts at deliberate adulteration or contamination of foods to produce mass casualties have been only occasionally successful. Nevertheless, the food supply of industrialized nations is vulnerable to terrorist attacks. A major problem is the inability to identify criminal intent rapidly in outbreaks of foodborne illness caused by common pathogens or animal-borne diseases. This review addresses the vulnerability of the food system, motivation for harm, detection of criminal intent and security measures that may minimize risks.

INTRODUCTION

The search for a safe and sufficient food supply has been a major human preoccupation throughout history. Foods are natural vehicles for pathogenic microbes and their toxins. Human beings have evolved protective biological and behavioral mechanisms to protect against accidental food poisoning, since many plants and animal tissues contain toxic constituents. The use of fire to cook food changed the safety as well as the taste of foods. The profusion of cookbooks and herbs, as well as the great variety of foods now available, attest to the fascination and the importance human beings attach to eating for pleasure and for health.

Agriculture is the largest sector of the United States economy, accounting for approximately one trillion dollars in overall impact annually, with an export market of approximately $190 billion. Agriculture accounts for 13% of the US gross domestic product and 15% of all global agricultural exports *(9)*. Agricultural terrorism is not about killing animals; it is a means to cripple an economy.

Infectious pathogens and poisons consumed in foods have been a time-honored method of assassination, siege, and terrorism *(10)*. The use of poisons for assassination reached its apogee in Renaissance Italy, and Shakespeare dramatized the use of poisons in the play Hamlet *(14, 26)*. Throughout history, the court taster was as much a part of the aristocratic entourage as the court jester; they were often the same person. During the past two centuries, food safety and sufficiency have been transformed from a household necessity to a public expectation; methods of safely preserving foods have moved from the household kitchen to sophisticated food processing plants as pickling, drying, freezing, and canning have become industries that stock our markets with a cornucopia of edibles. The contemporary capacity to grow, harvest, process, and market large quantities of foodstuffs that are safe and nutritious is as much an achievement for human health as the development of antibiotics and vaccines. However, the present-day food sys-

A peer-reviewed article

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TABLE 1. Terrorist objectives and motivation based on analysis of known events *(31)*

MOTIVATION	TYPE OF EVENTS	TYPE OF TARGET	TYPE OF GROUP
Interrupt production	Conspiracy only	Indiscriminate target	Single issue
Destroy production	Attempted acquistion of materials	Government target	Nationalist/Separatist
Destroy buildings		Defined group	Religious
Protest treatment of animals	Possession	Individual	Cults
Takeover	Threat	Building or company symbolic	Left wing
Abortion related issues	Attack		Right wing
	Hoax/Prank	Unknown	Lone psychopaths
Protest government in general	Unknown		Individual
Revenge for real or perceived injury			Unknown
Further Nationalist or Separatist objectives			
Target specific company			
Force compliance to a demand			
Fulfill apocalyptic prophecy			
Eco-terrorism			
Assassination			

tem, because of its success, is vulnerable to many types of chemical and biological contamination. That vulnerability extends to intentional attacks that use natural and synthetic adulterants and contaminants *(7, 8, 15, 17, 24, 27, 29)*. The food system is perhaps more vulnerable than ever before because of the complexity of the agricultural, transportation, food processing, and food distribution systems *(15, 17, 27)*; criminal interference is most difficult when food is grown, preserved, and prepared at home. The low cost of producing mycotoxins and the ease of accessibility to pathogens, poisons, and pesticides makes food contamination a low tech, effective act of terrorism.

Vulnerability of the food system

With an estimated 5 to 50 million cases of foodborne illness in the United States each year *(29)*, detection of a covert terrorist attack on food could be difficult unless a threat is made or responsibility claimed by a particular group. Any major foodborne outbreak will be initially investigated by public health authorities as a natural outbreak. Minor outbreaks may not be investigated because resources are limited and could therefore serve as "practice sessions" for terrorists. Intentional contamination of salad bars in several restaurants at The Dalles in Oregon in 1984 by a religious group using *Salmonella* Typhimurium caused 751 people to develop salmonellosis. However, this was later discovered by the FBI to be only a practice run for a planned future attack using either *S.* Typhimurium or *S.* Typhi which were already in the group's possession *(30)*. Infection with *S.* Typhi (causative agent of typhoid) would have resulted in significant morbidity and mortality.

A study completed in 1999 (ATSDR, 1999) listed chemical and food processing plants as targets for terrorist attack. The authors reported that 43% of all terrorist attacks were made upon business or industry. Some parts of the food system and some companies may be highly attractive targets to terrorists because of low

security, high employee turnover, low wages, and the presence of toxic chemicals, such as cleansers and pesticides, on site. HACCP (Hazard Analysis Critical Control Point) programs are designed to ensure a safe product in dealing with natural contamination but are not broad enough to prevent intentional contamination of the product.

Motivations for weaponizing foods

Using food as a weapon, methods of weaponizing food, and the choice of targets depend upon the motivations and objectives of the perpetrator(s) *(31)* (Table 1). There are, in fact, only a few methods to weaponize food: to contaminate it, to adulterate it, or to take it away. Destroying farmland, destroying crops, and stealing or destroying poultry and animals are among the oldest ways of using food as a weapon. Destruction of farms, crops, animals, and food supplies is a tactic of warfare between nations and armies. Food and water are generally considered inefficient means of causing large-scale mortality except for deaths from starvation and desiccation inflicted by interdiction of all food and water *(20)*. Limited destruction or contamination of animals or crops can, however, create chaos, fear, and economic losses. Outbreaks of fatal anthrax and botulism in cattle and dairy herds in Zimbabwe and Israel during troubled times in the past few years raise questions about agroterrorism.

An analysis of over 400 terrorist events by the Chemical and Biological Weapons Nonproliferation Project *(31)* shows a pattern as to the motivation, events, targets and perpetuating groups (Table 1). Although all forms of terrorism have increased over the last ten years, both actual incidences and hoaxes of biological terrorism have increased geometrically *(31)*.

Food and water are efficient vectors of localized morbidity following contamination or adulteration of water and food sources, water treatment facilities, and food processing facilities *(15, 25)*. As the processing and distribution of food become more complex and far-flung, people dependent upon others for their food supply are vulnerable to malnutrition and starvation by interruption of distribution, and to foodborne poisoning and infection by adulteration at steps along the food chain. Food and water are quite satisfactory vectors for pathogens causing both morbidity and mortality in target populations that are confined by geographic, industrial, or societal isolation, to separate or limited food sources and preparation, such as drill rigs at sea, military bases, refineries, schools, and restaurants. A variety of pathogens and poisons, easily available and applied, especially in operations with single-source suppliers and preparation, can kill or temporarily disable a community (Table 2) *(15)*. Contamination and adulteration of food and water for selected target populations are ideal methods for terrorists. Food bioterrorists are likely to be disgruntled individuals or ideologically driven groups, such as an angry employee of a supermarket or food processor, or groups advocating so-called direct action, such as the religious group that contaminated the salad bar at The Dalles with *Salmonella* in Oregon *(30)*.

Earlier assessments of the potential for bioterrorism emphasized attempts to cause large-scale infection or intoxication by aerial dispersion of anthrax or smallpox, in essence biologic mass casualties. Experience with anthrax in the fall of 2001 demonstrates just how hard it is to create mass casualties but how easy it is to create panic and fear with a small number of casualties. The complexity of and the complacency about food safety make food a desirable target for adversaries wanting to make a dramatic statement and create anxiety and terror.

Despite the rhetoric of post-September 11, 2001, it is vital that the public and the protectors of the public health understand that the objective of terrorists is not to wage a military war. Their objective is to create fear, mistrust, and panic by disrupting routine, regularity, and response (Table 1). The symbolic value of a successful incursion, even without death or destruction, should not be underestimated. Causing an outbreak of diarrhea can be extraordinarily satisfying for adversaries who want to illustrate their power and your vulnerability. It can be a most effective warning and can also create serious economic repercussions as consumers refuse to eat or purchase suspect foods. In fact, war is not good for terrorists, as the war in Afghanistan and the war status of the United States and its international allies demonstrate; the terrorist relishes the unsuspecting, trusting, and unprepared community, whereas the impact of the terrorist act is diminished by surveillance, by preparation, and by coordinated response.

POTENTIAL AGENTS TO WEAPONIZE FOODS

Most foodborne pathogens and toxins are "naturally" produced by bacteria, algae, fungi, and venomous creatures *(25)*. Moreover, many of these organisms have evolved life cycles adapted to the human condition and will continue to adapt even as we take measures to contain them. The notion that weaponizing foodborne pathogens requires sophisticated biological manipulation is a myth coming from ideas about using biologic weapons for mass casualties. All it takes to make food into a weapon is a bit of entrepreneurial spirit, basic microbiology, access to soil and manure, and fresh chicken in the grocery store, untreated water or an unsuspecting commercial microbiology supply house. The natu-

TABLE 2. The bioterrorist's food, water and agricultural weapons of choice

I. Assassination
   a. Botulinum toxin
   b. Cyanide; nitrites; heavy metals
   c. Mycotoxins: aflatoxins, mushroom (*Amanita phalloides*)
   d. Puffer fish
   e. Ricin (Castor bean)
   f. Algal and bacterial "bloom" toxins: saxitoxin, microcystins

II. Synchronous, disabling illness
   a. Enterotoxins from *Staphylococcus aureus*, *B. cereus*
   b. Endo-enterotoxin *Clostridium perfringens*
   c. Mycotoxins (aflatoxin, T-2, DON, DAS, islanditoxin, ochratoxin, rubratoxin, zearalenone, eltrin, etc.)
   d. Mushroom
   e. Dinoflagellate toxin

III. Diarrheal disease
   a. *Salmonella*
   b. *Campylobacter*
   c. *Vibrio cholerae*
   d. *Cryptosporidia*
   e. *Giardia*
   f. *Calicivirus* (Norwalk virus and others)
   g. *Shigella*
   h. *E. coli*

IV. Diarrheal disease with systemic complications
   a. *E. coli* O157:H7: hemolytic uremic syndrome
   b. *Salmonella* (enteric fever strains): arthritis, cardiomyopathy, soft tissue infection
   c. *Campylobacter:* Guillain-Barré syndrome
   d. *Yersinia enterocolitica*: cholestasis, arthritis, meningitis
   e. *Ascaris*: pulmonary infiltration, asthma, eosinophilia
   f. *Listeria monocytogenes*: miscarriage, meningitis

V. Animal and Crop Diseases
   a. Food and Mouth Disease
   b. Hog Cholera
   c. Velogenic Newcastle Disease
   d. Brucellosis
   e. Anthrax
   f. African Swine Fever
   g. Avian Influenza
   h. Rinderpest
   i. Wheat Smut
   j. Rice Blast
   k. Miscellaneous insect

TABLE 3. Properties of weaponized staphylococcal enterotoxins *(1)*

- Staphylococcal enterotoxin B (SEB) is produced by the bacterium *Staphylococcus aureus*
- Can be ingested or applied by aerosol. More toxic by aerosol
- Found in contaminated food or water; can be used to sabotage food or low-volume water supplies
- Incapacitating toxin: severe gastrointestinal pain, projectile vomiting, diarrhea, fever, chills, headache, muscle aches, shortness of breath, and cough
- Signs and symptoms develop in several hours and diminish after several more hours; full recovery is likely, but incapacitation may last for two weeks
- Stable in acidic and basic solutions, inactivated at 100°C after few minutes, does not survive long at ambient temperature
- Lethal by aerosol at 1.7 ug/ person; effective oral dose is 1–50 ug/ person
- Water treatment systems using charcoal should remove toxin

TABLE 4. Properties of weaponized botulinum toxins *(2, 5)*

- Weaponized for aerosol application
- More toxic when ingested than inhaled
- Progressive paralysis from head to toe, experienced within 24–36 hours
- Victim mentally alert throughout illness; death results from respiratory paralysis
- Lethal dose is about 0.5 ug/person
- Sunlight inactivates within 1–3 hours; detoxified in air within 12 hours; destroyed by 30 minutes at 80 degrees, after several minutes at 100 degrees, and boiling/sterilization
- Greater than 99.7% inactivated by 3 mg/ FAC (free available chlorine) in 20 minutes, and 84% inactivated by 0.4 mg/ FAC in 20 minutes

ral history of most foodborne pathogens makes them "natural" weapons. Using these organisms as weapons requires only the opportunity to insert them into the food system so that they will be viable and virulent when they are eaten. To the average person, biological weapons are mysterious, unfamiliar, indiscriminate, uncontrollable, inequitable and invisible. All of these characteristics contribute to the "outrage" factor associated with heightened fear *(28)*.

Causing an outbreak of diarrhea and vomiting synchronously among the members of a population would require a relatively rapid-acting enterotoxin-producing pathogen or a preformed toxin such as staphylococcal enterotoxin (Table 3) or *Bacillus cereus* enterotoxin. Rapid, assured killing would require a biologic weapon with efficient lethality and easily available foodborne agents. Most of the gastroenteritis-causing pathogens would not be effective. For lethality the list narrows significantly to botulinum toxins (Table 4), mycotoxins, including mushroom toxins (Table 5), and toxins produced by algae (Table 6), bacteria (Table 7), fish (Table 8), plants (Table 9), and pesticides *(11, 15)*.

Metals and synthetic compounds can also be used. One teaspoonful of a 20% solution of cyanide can be fatal *(22)*. Cyanide is rapidly absorbed and as little as 200 mg can cause morbidity and mortality in a healthy adult (Table 10). Cyanogenic plants can also be a source of cyanide; these include Christmas berries, velvet grass, lima beans, and fruit seeds *(11)*. Depending on the dose, these sources of cyanide can produce dry mouth, itchy throat and ultimately confusion, seizures, and coma. Heavy metals, such as arsenic, have equivalent potency, with as little as 120 mg causing mortality in a healthy adult *(16)*. Again, depending on the dose, this metal can be introduced as a food adulterant and result in significant morbidity (abdominal pain and vomiting) and mortality (Table 11).

DETECTING CRIMINAL ADULTERATION OR CONTAMINATION OF FOOD

Thallium, like arsenic, a common rodenticide, is often used for assassinations (Table 12) *(21)*. A recent outbreak of methemoglobinemia *(12)* among a family in New York City illustrates the ease with which ordinary, commonplace comestibles can be altered or adulterated and consumed by unsuspecting victims (Table 13).

Because the majority of pathogens and poisons that contaminate

TABLE 5. Properties of weaponized toxins from fungi

Mycotoxins: Aflatoxins *(11, 23)*

- Metabolites of mold *Aspergillus flavus* that infects agricultural plants
- Lack properties for biological warfare but have been weaponized for missile delivery
- Signs and symptoms: jaundice, rapidly developing ascites, portal hypertension, high mortality rate from massive gastrointestinal bleeding
- In children, produces Reye's syndrome
- Effective dose is 2–6 mg/day
- Has limited water solubility and is heat stable. Inactivated by 500 mg/l FAC in 20 minutes
- An LD 50 (lethal dose) is 10–100 mg/person

Mycotoxins: T-2 *(11, 19)*

- One of several trichothecene mycotoxins isolated from cereal grains infected with Fusarium and some other genera of fungi
- Deadly threat if ingested
- LD_{50} greater than several hundred micrograms/kg
- Suspected use in Cambodia, Laos, and Iraq ("yellow rain")
- Ingestion causes lightheadedness, nausea, vomiting, and diarrhea
- Breakdown in water at room temperature does not occur fast enough in 7 days to negate potential health concerns
- Less than 3% inactivated by 100 mg/l FAC after 30 minute exposure at room temperature; iodine has no effect at 16 mg/l
- Treatment system using charcoal should effectively remove toxin

TABLE 6. Properties of weaponized saxitoxin *(3, 13)*

- Extremely toxic by ingestion and aerosol application
- Has been weaponized for covert purposes
- Signs and symptoms: occur within 30 minutes after ingestion — abdominal distress, diarrhea, nausea, vomiting, vertigo, headache, rapid pulse, numbness of tongue and gums, leading to paralysis
- Death occurs in 1–24 hours due to respiratory failure
- Human lethal dose is 0.3–3.0 mg/ person
- No effective treatment
- Water soluble, acid stable, alkaline labile, and stable at normal atmosphere conditions
- Unaffected by 30 minute exposure to 10 mg/l FAC; > 99% inactivated at 100 mg/l FAC
- Iodine has no effect at 10 mg/l

food occur naturally, determining that an outbreak of foodborne illness is the result of a criminal act can be extraordinarily difficult. Pathogens have no easily identified markers that indicate a criminal or terrorist origin. The Oregon *Salmonella* incident was not recognized as a result of hostile intent for over a year, and then only when the perpetrators were exposed by co-conspirators. New techniques such as PCR, Riboprinting and PFGE (pulsed field gel electrophoresis) can identify pathogens with great precision so that linkages to other episodes and sources can be determined. However, these are specialized methods not always immediately accessible to first and community health responders.

Outbreaks of infections with naturally occurring foodborne pathogens affecting several or many victims are the most difficult to recognize as criminal incidents *(25)*. The use of other adulterants, such as synthetic chemicals or unusual toxins, especially to injure a single person or a small group, would arouse immediate suspicion. The use of poisons such as arsenic and cyanide would raise suspicion of criminal activity because of the adulterant selected. However, heavy metals like arsenic may be introduced in low concentration and produce morbidity and mortality gradually, similar to the arsenic poisoning that is the result of natural contamination of water, as in Bangladesh *(16)*. Questions exist today as to the infectivity, toxicity and stability of various toxins and pathogens in foods which are not typically foodborne, such as *Yersinia pestis* and *Bacillus anthracis*.

Many people are concerned that public disclosure and discussion of terrorism may foster such attacks. Unfortunately, such questions are not easily investigated by science. We firmly believe that ignorance is not bliss, and that heightened surveillance and risk management are the best extant defenses against bioterrorism. Contaminating restaurant food with

TABLE 7. Properties of weaponized cyanobacteria *(18)*

Anatoxin A *(11)*

- Very fast death factor
- Produced by filamentous freshwater cyanobacteria
- Signs; staggering, gasping, convulsions; death occurs in minutes to hours by respiratory arrest
- LD_{50} (lethal dose) for mice is 200 ug/kg with 4–7 minute survival rate
- Alum flocculation, filtration, and chlorine are ineffective in removal of cyanobacterial toxins
- Hepatotoxic products of freshwater blooms of cyanobacteria
- Microcystin LR is known as the fast death factor
- Most common species and toxin of choice to be weaponized is Microcystin
- Greatest threat in aerosolized form
- Ingestion from natural sources significant hazard
- Mice administered aerosol LD_{50}, 67 ug/kg, died within hours
- Water soluble and temperature stable
- Unaffected by 30 minute exposure to 100 mg/l FAC: iodine has no effect at 16 mg/l

TABLE 8. Properties of weaponized tetrodotoxin *(3, 13)*

- Potent neurotoxin causing death — can be obtained from puffer fish
- Poisoning appears within 10 minutes to 4 hours after ingestion
- Produces numbness of lips, tongue, and fingers, anxiety, nausea, and vomiting, progressing to paralysis
- Death occurs within 6 hours due to respiratory failure
- Oral lethal dose is 1–2 mg
- Soluble is slightly acid water and is temperature stable
- Rapidly inactivated by 50 mg/l chlorine at pH < 3 and > 9

Salmonella has been successful at least once in the United States *(30)*, and the toxins of botulism are known to reside in the armamentariums of a variety of organizations and nations. Over the past few years, the federal government has become increasingly conscious of the risks posed by chemical and biological weapons and has been active in alerting state and local agencies and training emergency response personnel *(7)*.

PREPARING FOR A TERRORIST OR CRIMINAL ACT

Thinking about and preparing for bioterrorism requires thinking like a criminal conspirator intent upon doing serious harm to people and property. Any intelligent conspirator will look for vulnerable points for infiltration and attack and will evaluate them for susceptibility to weaponry and strategy (Table 14). Weaponry and strategy are shaped by the objectives of the attack. The nature of the selected weapon will then determine the point of attack. Chemicals or infectious pathogens can be added at various points in the food supply, including using water as the vehicle *(15)*. The longer the distance between the consumer and the point of adulteration, the more specialized the adulterant must be in order to be viable or to be toxic when ingested.

The food and water supply are susceptible to bioterrorism at the source, during transportation from the source to the site, and during storage and preparation at the site. When local sources of food are inadequate or unsafe, provisions must be purchased at markets at some distance from the site and then transported to the site; the longer the transportation distance and the more frequent changes in transport vehicles, and therefore handling, the greater the opportunity for tampering. A clever terrorist can substitute adulterated or contaminated food, cleansers, ingredients, and processing aids at the source or at a transfer point along the transport route.

Attack from a distance

The logistics of the present food system usually means that food staples with long shelf life are purchased in bulk and fresh items are purchased locally and more frequently. Bulk staples such as rice, flour, cereals and cornmeal are one target for bioterrorism. Contamination with aflatoxins or heat stable, tasteless, long-lived chemicals could wreak havoc, with mortality dispersed throughout a community over a long period of time. The greater the distance and time between the adulterant/contaminant act and the point of attack, the more stable and potent the weapon must be, which means that most live, nonspore-forming pathogens and viruses are unsuitable. Stable toxins such as aflatoxin and botulinum toxin are satisfactory, as are spore-forming pathogens such as

TABLE 9. Properties of weaponized ricin *(4, 11)*

- Derived from beans of the castor plant
- Not a threat as a weapon of mass destruction; used as an assassin's weapon
- Less potent by ingestion and most potent when injected
- Signs and symptoms: CNS affected soon after injection, heart function decreases, convulsions and then death occur
- Ingestion causes gastrointestinal hemorrhage (bloody diarrhea) with organ necrosis
- Detoxified in 10 minutes at 80°C and in less than 1 hour at 50°C; stable under ambient conditions
- Lethal dose for humans is a 50–100 ug dose by oral ingestion
- Greater than 99.4% inactivated after 20 minutes with FAC treatment at 100 mg/l; unchanged at 10 mg/l
- Iodine has no measurable effect at 16 mg/l
- Water treatment system using charcoal should effectively remove toxin

TABLE 10. Properties of weaponized cyanide *(22)*

- Potent oral poison producing signs and symptoms in minutes and death in minutes to hours
- One teaspoonful of 20% solution of cyanide has been fatal
- Lethal oral dose of cyanide salts is 3–4 mg/kg
- Rapidly absorbed and acting chemical asphyxiant
- Cyanogenic plants: Christmas berry, velvet grass, lima beans, fruit seeds
- Dry mouth, itchy throat, metallic taste, air hunger, hyperpnea headache, sweating, flushed skin, stertorous breathing, anxiety, agitation, muscle rigidity, fever, ataxia, aphasia, confusion, lethargy, seizures, loss of consciousness, and coma
- Vomiting, strong irritant effect on gastric mucosa, pulmonary edema, and lactic acidosis occur after ingestion
- Treatment consists of nitrites, supplemental thiosulfate and hydroxocobalamin

TABLE 11. Properties of weaponized arsenic *(16)*

- Corrosive metal producing high morbidity and mortality
- Fatal dose is 120 mg
- Signs and symptoms: ingestion — abdominal pain, vomiting, watery diarrhea, low blood pressure, pulse irregularity, gastrointestinal inflammation and irritation with hemorrhage; results in stupor, convulsions, coma, and death
- Produces adverse effects in the respiratory tract, nervous system, liver, cardiovascular system, and hematopoietic system; has systemic effects in kidneys, producing acute renal tubular necrosis and glomerular damage

Bacillus anthracis. Bioweapons inserted at a distance are aimed at the total population of a food source line, the food processor, transporter, retailer, or kitchen.

Food purchased at distant markets must be packaged for safe transport. A single supplier offers the best opportunity to adulterate food items because all of the items will be assembled and kept in a single location; substitution and adulteration of a whole shipment is thus possible. Similarly, food supplies trucked from the supplier to multiple distributors or to an airport or train, and then into another truck before arrival at the final distribution point, offer adversaries multiple opportunities for contact with the shipment. Every transfer point is a terrorist opportunity. When multiple suppliers are used, transfers during transportation allow access to the total shipment.

Attack from the vicinity

Fresh foods from local or near markets are a target for contamination with a variety of pathogens — bacteria, parasites, and protozoa — that can cause gastroenteric diseases that disable but usually do not kill. Contamination of water cisterns or fresh foods with cysts of *Cryptosporidium*, *Giardia*, *Cyclospora*, *Taenia* or *Ascaris* would produce high morbidity and little mortality. Using bacteria like *Salmonella* or *Campylobacter* would also result in morbidity without substantial lethality (< 1%). As a method of exposing a military outpost to piracy and takeover without cessation of operations, these are ideal biologic weapons. These agents could also be highly effective for industrial sabotage.

Local supplies of meat can be contaminated with bacteria such as anthrax, *Listeria* or *E. coli* O157:H7 *(15)*. Recently an outbreak of anthrax in cattle caused several deaths and over 600 hospitalizations in Zimbabwe. People had been slaughtering infected cows and selling the meat, or consuming it themselves *(6)*. Re-

TABLE 12. Properties of weaponized thallium *(21)*

- Frequently used for murder and suicide
- Lethal oral human dose is 15–20 mg/ kg of body weight
- Rapidly absorbed by ingestion
- After 1–2 hours, 100% absorbed from the gastrointestinal tract; highest concentration found in the renal medulla
- Signs and symptoms: nausea, vomiting, abdominal pain, tachycardia, and headaches; neurological symptoms begin in 2–5 days
- No effective treatment

TABLE 13. Toxic properties of nitrites *(12)*

- Produce methemoglobinemia: inhibits ability of hemoglobin to carry oxygen
- Gram quantities required to produce morbidity
- Headache, nausea, vomiting, hypotension, and syncope occur after ingestion

TABLE 14. Risks for food and water bioterrorist attack

1. Limited suppliers: no effective food security program, high labor turnover, uneducated workers, low wages
2. Long distances between supply source and site
3. Multiple transfers of supplies between supply source and site
4. Insecure water supply and treatment facility
5. Using local suppliers and food handlers in regions with antipathy or hostility
6. Unaudited food and water supply, transportation, preparation
7. Large and diversified distribution
8. Food accessibility to anyone

gional seafood, especially shellfish such as clams, oysters, and mussels, can be harvested from waters endemic for hepatitis, cholera and other vibrios, or toxin-producing Dinoflagellate blooms *(3)*. Cooked or smoked seafood such as shrimp or salmon may be intentionally contaminated since most pathogens survive refrigeration temperatures for at least three weeks. Unscrupulous or hostile suppliers of meat and seafood can easily jeopardize the health of a community.

These organisms can also be inserted into the water supply, which can be damaged so that purification by filtration, chlorination, or ozonation is ineffective or inoperative. Live pathogens or cysts are ideal weapons for intermediate distances and time and are intended for the total population, not a specific individual or subgroup. Their effects are not immediate.

Terrorists wanting to produce rapid synchronous onset of illness would use exotoxins from *Staphylococcus aureus*, *Bacillus cereus*, or *Clostridium botulinum*. Such toxins would be most efficient placed in ready-to-eat foods or liquids. Milk, juices, mayonnaise, catsup or other commonly consumed foods are ideal vehicles.

Attack from within

Infiltrating the food handling staff permits the adversary to be highly specific in selecting the target populations and the timing of a bioterrorist attack. In this strategy, particular meals or the food for a particular person are the vehicle for the biologic weapon. Specificity, however, is accompanied by discoverability and greater risks for failure or retribution for the attack. The adversary will be constrained from adulterating food or water supplies distant from the site because of the potential for sickening their accomplices on site unless, of course, the infiltrators are expendable. An easily overlooked group of employees are the maintenance and sanitation staff who often have access to every part of a food facility.

An alternative strategy is to utilize a vector: an infected creature — human or nonhuman — that could purposefully transmit their infectious organisms within the enclave. In days gone by, dead victims of the plague were catapulted into besieged cities *(10)*. New plagues have emerged. A particularly vicious adversary might consider sending expendable individuals infected with *Vibrio cholera* or *Salmonella* Typhi into a facility. People with viral gastroenteritis, such as Norwalk virus, could be sent to transport local foodstuffs or to work in the kitchen, after being intructed to contaminate food and/or water to produce an outbreak of diarrheal disease. A known carrier of *Salmonella* or *Giardia* could accomplish the same objective.

Adulterating food for a specific group or person requires the action of an on-site food handler. If the objective is assassination, the weapon is most likely cyanide or botulinum toxin placed in the food portions intended

TABLE 15. Recommendations for food and water protection

KEY ISSUE	KEY ACTIVITY
Management of Food Security	Security Procedures Investigation of suspicious activities Supervision/Staff Roles Mail/Packages
Employees	Pre-Hire Screening Identification Access Control Training
Data Systems	Data Security Software and Hardware Security Routine auditing of computer systems
Physical Security	Visitors Delivery Shippers Employees Environment
Product Security	Product Sources Auditing Shipping/Receiving Identification Transport Security
Security Plan	People Strategy Information and Coordination Periodic Auditing of Plan Commitment of Top Company Officials

for the target. A creative assassin may select fugu or seafood contaminated by dynoflagellate toxins. If the objective is an illness outbreak, then bacterial contaminants such as *Salmonella*, *Campylobacter*, *E. coli* O157:H7, parasitic or protozoan cysts such as *Cryptosporidia*, or bacterial toxins would be suitable.

CONCLUSION

Food and water are excellent targets for bioterrorism. Several obvious risk factors can be identified and can be used to assess the potential dangers against food (Table 2). Some of these protective actions can be seen in Table 15.

A process called Operational Risk Management (ORM) can assist managers in prioritizing preventative measures that are most likely to have the greatest impact on reducing the tampering, criminal or terrorist actions under their control.

Perhaps the most important cautionary principle is to make food and water safety and food security a serious, high priority matter. An effective food safety and food security program using SOPs for preventing natural or intentional contamination is needed for all parts of the food system, including farms, aquaculture facilities, fishing vessels, importers, producers, transporters, processing facilities, packing houses, warehouses, distributors, and food service operations. Implementing enhanced security measures requires the commitment of government, management, and employees at each step of the food system.

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International Association for Food Protection®

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DAIRY

D1180 **10 Points to Dairy Quality**–(10 minute videotape). Provides in-depth explanation of a critical control point in the residue prevention protocol. Illustrated with on-farm, packing plant, and milk-receiving plant scenes as well as interviews of producers, practicing veterinarians, regulatory officials and others. (Dairy Quality Assurance–1992) (Reviewed 1998)

D1010 **The Bulk Milk Hauler: Protocol & Procedures**–(8 minute videotape). Teaches bulk milk haulers how they contribute to quality milk production. Special emphasis is given to the hauler's role in proper milk sampling, sample care procedures, and understanding test results. (Iowa State University Extension–1990). (Reviewed 1998)

D1030 **Cold Hard Facts**–This video is recommended for training personnel associated with processing, transporting, warehousing, wholesaling and retailing frozen foods. It contains pertinent information related to good management practices necessary to ensure high quality frozen foods. (National Frozen Food Association–1993) (Reviewed 1998)

D1040 **Ether Extraction Method for Determination of Raw Milk**–(26 minute videotape). Describes the ether extraction procedure to measure milkfat in dairy products. Included is an explanation of the chemical reagents used in each step of the process. (CA–1988) (Reviewed 1998)

D1060 **Frozen Dairy Products**–(27 minute videotape). Developed by the California Department of Food and Agriculture. Although it mentions the importance of frozen desserts, safety and checking ingredients; emphasis is on what to look for in a plant inspection. Everything from receiving, through processing and cleaning and sanitizing is outlined, concluded with a quality control program. Directed to plant workers and supervisors, it shows you what should be done. (CA–1987) (Reviewed 1997)

D1070 **The Gerber Butterfat Test**–(7 minute videotape). Describes the Gerber milkfat test procedure for dairy products and compares it to the Babcock test procedure. (CA–1990) (Reviewed 1998)

D1080 **High-Temperature, Short-Time Pasteurizer**–(59 minute videotape). Provided by the Dairy Division of Borden, Inc. It was developed to train pasteurizer operators and is well done. There are seven sections with the first covering the twelve components of a pasteurizer and the purpose and operation of each. The tape provides the opportunity for discussion after each section or continuous running of the videotape. Flow diagrams, processing and cleaning are covered. (Borden, Inc.–1986) (Reviewed 1997)

D1090 **Managing Milking Quality**–(33 minute videotape). This training video is designed to help dairy farmers develop a quality management process and is consistent with ISO 9000 certification and HACCP processes. The first step is to evaluate the strengths and weaknesses of a dairy operation. The video will help you find ways to improve the weaknesses that are identified on your farm.

D1100 **Mastitis Prevention and Control**–(2-45 minute videotapes). This video is ideal for one-on-one or small group presentations. Section titles include: Mastitis Pathogens, Host Defense, Monitoring Mastitis, Mastitis Therapy, Recommended Milking Procedures, Postmilking Teat Dip Protocols, Milk Quality, Milking Systems. (Nasco–1993)

D1105 **Milk Hauler Training** – (35 minute videotape). This video covers the procedures and duties of the Milk Hauler from the time of arrival at the dairy farm, to the delivery of the milk at the processing plant. It also provides the viewer with a general understanding of the quality control issues involved in milk production and distribution. Topics include milk composition breakdown, milk fat content measurement, testing for added water, antibiotic and pesticide residues, somatic cell and bacteria counts, sediment, and aflatoxins. (Avalon Mediaworks LLC– 2003)

D1110 **Milk Plant Sanitation: Chemical Solution**–(13 minute videotape). This explains the proper procedure required of laboratory or plant personnel when performing chemical titration in a dairy plant. Five major titrations are reviewed... alkaline wash, presence of chlorine and iodophor, and caustic wash and an acid wash in a HTST system. Emphasis is also placed on record keeping and employee safety. (1989)

D1120 **Milk Processing Plant Inspection Procedures**–(15 minute videotape). Developed by the California Department of Food and Agriculture. It covers pre- and post-inspection meeting with management, but emphasis is on inspection of all manual and cleaned in place equipment in the receiving, processing and filling rooms. CIP systems are checked along with recording charts and employee locker and restrooms. Recommended for showing to plant workers and supervisors. (CA–1986)

D1125 **Ohio Bulk Milk Hauling** – (15 minute videotape). Milk haulers, weighers, and samplers are the most constant link between the producer, the producer cooperative, and the milk processor. This video shows their complete understanding of all aspects of farm milk collection and handling, milk quality and quality tests, and sanitation and sanitary requirements that contribute to the trust between the producer and the dairy plant. The video educates prospective haulers, weighers, and samplers throughout Ohio. (Ohio State University –2001)

D1130 **Pasteurizer – Design and Regulation**–(16 minute videotape). This tape provides a summary of the public health reasons for pasteurization and a nonlegal definition of pasteurization. The components of an HTST pasteurizer, elements of design, flow-through diagram and legal controls are discussed. (Kraft General Foods–1990) (Reviewed 1998)

D1140 **Pasteurizer – Operation**–(11 minute videotape). This tape provides a summary of the operation of an HTST pasteurizer from start-up with hot water sanitization to product pasteurization and shutdown. There is an emphasis on the legal documentation required. (Kraft General Foods–1990) (Reviewed 1998)

D1150 **Processing Fluid Milk**–(30 minute–140 slides–script–tape). This slide set was developed to train processing plant personnel on preventing food poisoning and spoilage bacteria in fluid dairy products. Emphasis is on processing procedures to meet federal regulations and standards. Processing procedures, pasteurization times and temperatures, purposes of equipment, composition standards, and cleaning and sanitizing are covered. Primary emphasis is on facilities such as drains and floors, and filling equipment to prevent post-pasteurization contamination with spoilage or food poisoning bacteria. It was reviewed by many industry plant operators and regulatory agents and is directed to plant workers and management. (Penn State–1987) (Reviewed 1998)

ENVIRONMENTAL

E3010 **The ABCs of Clean–A Handwashing & Cleanliness Program for Early Childhood Programs**–For early childhood program employees. This tape illustrates how proper handwashing and clean hands can contribute to the infection control program in daycare centers and other early childhood programs. (The Soap & Detergent Association–1991)

E3020 **Acceptable Risks?**–(16 minute videotape). Accidents, deliberate misinformation, and the rapid proliferation of nuclear power plants have created increased fears of improper nuclear waste disposal, accidents during the transportation of waste, and the release of radioactive effluents from plants. The program shows the occurrence of statistically anomalous leukemia clusters; governmental testing of marine organisms and how they absorb radiation; charts the kinds and amounts of natural and man-made radiation to which man is subject; and suggests there is no easy solution to balancing our fears to nuclear power and our need for it. (Films for the Humanities & Sciences, Inc.–1993) (Reviewed 1998)

E3030 **Air Pollution: Indoor**–(26 minute videotape). Indoor air pollution is in many ways a self-induced problem...which makes it no easier to solve. Painting and other home improvements have introduced pollutants, thermal insulation and other energy-saving and water-proofing devices have trapped the pollutants inside. The result is that air pollution inside a modern home can be worse than inside a chemical plant. (Films for the Humanities & Sciences, Inc.) (Reviewed 1998)

E3031 **Allergy Beware** – (15 minute videotape). Designed to educate food and beverage company employees about their role in preventing an accidental allergic reaction caused by a product their company produces. Recommended for product development, production, labeling, scheduling and cleaning. Everyone has an important role to prevent cross-contamination and mislabeling issues. (Food and Consumer Products Manufacturers of Canada– 2003)

E3040 **Asbestos Awareness**–(20 minute videotape). This videotape discusses the major types of asbestos and their current and past uses. Emphasis is given to the health risks associated with asbestos exposure and approved asbestos removal abatement techniques. (Industrial Training, Inc.–1988) (Reviewed 1998)

E3055 **Effective Handwashing–Preventing Cross-Contamination in the Food Service Industry**–(3 1/2 minute videotape). It is critical that all food service workers wash their hands often and correctly. This video discusses the double wash method and the single wash method and when to use each method. (Zep Manufacturing Company–1993)

E3060 **EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)**–(22 minute videotape). Demonstrates the Ceriodaphnia 7-Day Survival and Reproduction Toxicity Test and how it is used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. The tape covers the general procedures for the test including how it is set up, started, monitored, renewed and terminated. (1989) (Reviewed 1998)

E3070 **EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)**–(15 minute videotape). A training tape that teaches environmental professionals about the Fathead Minnow Larval Survival and Growth Toxicity Test. The method described is found in an EPA document entitled, "Short Term Methods for Estimating the Chronic Toxicity of Effluents & Receiving Waters to Freshwater Organisms." The tape demonstrates how fathead minnow toxicity tests can be used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. (1989) (Reviewed 1998)

E3075 **EPA: This is Super Fund**–(12 minute videotape). Produced by the United States Environmental Protection Agency (EPA) in Washington, D.C., this videotape focuses on reporting and handling hazardous waste sites in our environment. The agency emphasizes community involvement in identifying chemical waste sites and reporting contaminated areas to the authorities. The primary goal of the "Super Fund Site Process" is to protect human health and to prevent and eliminate hazardous chemicals in communities. The film outlines how to identify and report abandoned waste sites and how communities can participate in the process of cleaning up hazardous sites. The program also explains how federal, state and local

governments, industry and residents can work together to develop and implement local emergency preparedness/response plans in case chemical waste is discovered in a community.

E3080 **Fit to Drink**–(20 minute videotape). This program traces the water cycle, beginning with the collection of rain-water in rivers and lakes, in great detail through a water treatment plant, to some of the places where water is used, and finally back into the atmosphere. Treatment of the water begins with the use of chlorine to destroy organisms; the water is then filtered through various sedimentation tanks to remove solid matter. Other treatments employ ozone, which oxidizes contaminants and makes them easier to remove; hydrated lime, which reduces the acidity of the water; sulfur dioxide, which removes any excess chlorine; and floculation, a process in which aluminum sulfate causes small particles to clump together and precipitate out. Throughout various stages of purification, the water is continuously tested for smell, taste, titration, and by fish. The treatment plant also monitors less common contaminants with the use of up-to-date techniques like flame spectrometers and gas liquefaction. (Films for the Humanities & Sciences, Inc.–1987)

E3110 **Garbage: The Movie**–(25 minute videotape). A fascinating look at the solid waste problem and its impact on the environment. Viewers are introduced to landfills, incinerators, recycling plants and composting operations as solid waste management solutions. Problems associated with modern landfills are identified and low-impact alternatives such as recycling, reuse, and source reduction are examined. (Churchill Films) (Reviewed 1998)

E3120 **Global Warming: Hot Times Ahead**–(23 minute videotape). An informative videotape program that explores the global warming phenomenon and some of the devastating changes it may cause. This program identifies greenhouse gases and how they are produced by human activities. Considered are: energy use in transportation, industry and home; effects of deforestation, planting of trees and recycling as means of slowing the build-up of greenhouse gases. (Churchill Films–1995)

E3130 **Kentucky Public Swimming Pool & Bathing Facilities**–(38 minute videotape). Developed by the Lincoln Trail District Health Department in Kentucky and includes all of their state regulations which may be different from other states, provinces and countries. This tape can be used to train those responsible for operating pools and waterfront bath facilities. All aspects are included of which we are aware, including checking water conditions and filtration methods. (1987). (Reviewed 1998)

E3135 **Plastics Recycling Today: A Growing Resource**–(11:35 minute videotape). Recycling is a growing segment of our nation's solid waste management program. This video shows how plastics are handled from curbside pickup through the recycling process to end-use by consumers. This video provides a basic understanding of recycling programs and how communities, companies and others can benefit from recycling. (The Society of the Plastics Industry, Inc.–1988)

E3140 **Putting Aside Pesticides**–(26 minute videotape). This program probes the long-term effects of pesticides and explores alternative pest-control efforts; biological pesticides, genetically-engineered microbes that kill objectionable insects, the use of natural insect predators, and the cross-breeding and genetic engineering of new plant strains that produce their own anti-pest toxins. (Films for the Humanities & Sciences, Inc.) (Reviewed 1999)

E3150 **Radon**–(26 minute videotape). This program looks at the possible health implications of radon pollution, methods home-owners can use to detect radon gas in their homes, and what can be done to minimize hazards once they are found.

E3160 **RCRA–Hazardous Waste**–(19 minute videotape). This videotape explains the dangers associated with hazardous chemical handling and discusses the major hazardous waste handling requirements presented in the Resource Conservation and Recovery Act. (Industrial Training, Inc.)

E3161 **The Kitchen Uncovered Orkin Sanitized EMP**–(13 minute videotape). This video teaches restaurant workers what they can do to prevent pest infestation, and what health inspectors look for. An excellent training tool for food service workers that can be used in conjunction with HACCP instruction. (Orkin Pest Control–1997)

The New Superfund. What It is & How It Works–A six-hour national video conference sponsored by the EPA. Target audiences include the general public, private industry, emergency responders and public interest groups. The series features six videotapes that review and highlight the following issues:

E3170 **Tape 1–Changes in the Remedial Process: Clean-up Standards and State Involvement Requirements**–(62 minute videotape). A general overview of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the challenge of its implementation. The remedy process — long-term and permanent clean-up is illustrated step-by-step, with emphasis on the new mandatory clean-up schedules, preliminary site assessment petition procedures and the hazard ranking system/National Priority List revisions. The major role of state and local government involvement and responsibility is stressed.

E3180 **Tape 2–Changes in the Removal Process: Removal and Additional Program Requirements**–(48 minute videotape). The removal process is a short-term action and usually an immediate response to accidents, fires and illegal dumped hazardous substances. This program explains the changes that expand removal authority and require procedures consistent with the goals of remedial action.

E3190 **Tape 3–Enforcement & Federal Facilities**–(52 minute videotape). Who is responsible for SARA clean-up costs? Principles of responsible party liability; the difference between strict, joint and several liability; and the issue of the innocent land owner are discussed. Superfund enforcement tools-mixed funding, De Minimis settlements and the new nonbinding preliminary allocations of responsibility (NBARs) are explained.

E3210 **Tape 4–Emergency Preparedness & Community Right-to-Know**–(48 minute videotape). A major part of SARA is a free-standing act known as Title III: The Emergency Planning and Community Right-to-Know Act of 1986, requiring federal, state, and local governments and industry to work together in developing local emergency preparedness/response plans. This program discusses local emergency planning committee requirements, emergency notification procedures, and specifications on community right-to-know reporting requirements such as using OSHA Material Safety Data Sheets, the emergency & hazardous chemical inventory and the toxic chemical release inventory.

E3220 **Tape 5–Underground Storage Tank Trust Fund & Response Program**–(21 minute videotape). Another addition to SARA is the Leaking Underground Storage Tank (LUST) Trust Fund. One half of the US population depends on ground water for drinking—and EPA estimates that as many as 200,000 underground storage tanks are corroding and leaking into our ground water. This program discusses how the LUST Trust Fund will be used by EPA and the states in responding quickly to contain and clean-up LUST releases. Also covered is state enforcement and action requirements, and owner/operator responsibility.

E3230 **Tape 6–Research & Development/ Closing Remarks**–(33 minute videotape). An important new mandate of the new Superfund is the technical provisions for research and development to create more permanent methods in handling and disposing of hazardous wastes and managing hazardous substances. This segment discusses the SITE (Superfund Innovative Technology Evaluation) program, the University Hazardous Substance Research Centers, hazardous substance health research and the DOD research, development and demonstration management of DOD wastes.

E3240 **Sink a Germ**–(10 minute videotape). A presentation on the rationale and techniques for effective handwashing in health care institutions. Uses strong imagery to educate hospital personnel that handwashing is the single most important means of preventing the spread of infection. (The Brevis Corp.–1986). (Reviewed 1998)

E3245 **Wash Your Hands**–(5 minute videotape). Handwashing is the single most important means of preventing the spread of infection. This video presents why handwashing is important and the correct way to wash your hands. (LWB Company–1995)

E3250 **Waste Not: Reducing Hazardous Waste**–(35 minute videotape). This tape looks at the progress and promise of efforts to reduce the generation of hazardous waste at the source. In a series of company profiles, it shows activities and programs within industry to minimize hazardous waste in the production process. Waste Not also looks at the obstacles to waste reduction, both within and outside of industry, and considers how society might further encourage the adoption of pollution prevention, rather than pollution control, as the primary approach to the problems posed by hazardous waste. (Umbrella films)

FOOD

F2260 **100 Degrees of Doom... The Time & Temperature Caper**–(14 minute videotape). Video portraying a private eye tracking down the cause of a *Salmonella* poisoning. Temperature control is emphasized as a key factor in preventing foodborne illness. (Educational Communications, Inc.–1987) (Reviewed 1998)

F2450 **A Guide to Making Safe Smoked Fish**–(21 minute videotape). Smoked fish can be a profitable product for aquaculturalists, but it can be lethal if not done correctly. This video guides you through the steps necessary to make safe smoked fish. It provides directions for brining, smoking, cooling, packaging and labeling, and cold storage to ensure safety. The video features footage of fish smoking being done using both traditional and modern equipment. (University of Wisconsin-Madison–Spring, 1999)

F2005 **A Lot on the Line**–(25 minute videotape). Through a riveting dramatization, "A Lot on the Line" is a powerful training tool for food manufacturing and food service employees. In the video, a food plant supervisor and his pregnant wife are eagerly awaiting the birth of their first child. Across town, a deli manager is taking his wife and young daughter away for a relaxing weekend. Both families, in a devastating twist of fate, will experience the pain, fear, and disruption caused by foodborne illness. This emotionally charged video will enthrall new and old employees alike and strongly reinforce the importance of incorporating GMPs into everyday work routines. Without question, "A Lot on the Line" will become an indispensable part of your company's training efforts. (Silliker Laboratories–2000)

F2007 **The Amazing World of Microorganisms**–(12 minute videotape). This training video provides your employees with an overview of how microorganisms affect their everyday lives and the foods they produce.

The video explores how microscopic creatures are crucial in producing foods, fighting disease, and protecting the environment. In addition, certain microorganisms—when given the proper time and conditions to grow—are responsible for food spoilage, illness, and even death. Equipped with this knowledge, your employees will be better able to protect your brand. (Silliker Laboratories Group, Inc., Homewood, IL– 2001)

F2008 **A Recipe for Food Safety Success**–(30 minute videotape). This video helps food-industry employees understand their obligations in the areas of safety and cleanliness… what the requirements are, why they exist, and the consequences for all involved if they're not adhered to consistently. Critical information covered includes the role of the FDA and USDA; HACCP systems; sanitation and pest control; time and temperature controls that fight bacteria growth, and the causes and effects of pathogens. (J. J. Keller – 2002)

F2009 **Basic Personnel Practices** – (18 minute videotape). This training video covers the practical GMPs from the growing field to the grocery store with a common sense approach. Employees learn the necessary training to help them understand the basic principles of food safety. (AIB International– 2003)

F2440 **Cleaning & Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!**–(16 minute videotape) This training video shows how to safely and effectively clean and sanitize in a vegetable processing plant. It teaches how it is the same for processing plant as it is for washing dishes at home. (University of Wisconsin Extension–1996) (Available in Spanish)

F2010 **Close Encounters of the Bird Kind**–(18 minute videotape). A humorous but in-depth look at *Salmonella* bacteria, their sources, and their role in foodborne disease. A modern poultry processing plant is visited, and the primary processing steps and equipment are examined. Potential sources of *Salmonella* contamination are identified at the different stages of production along with the control techniques that are employed to insure safe poultry products. (Topek Products, Inc.) (Reviewed 1998)

F2015 **Controlling *Listeria*: A Team Approach**–(16 minute videotape). In this video, a small food company voluntarily shuts down following the implication of one of its products in devastating outbreak of *Listeria monocytogenes*. This recall dramatization is followed by actual in-plant footage highlighted key practices in controlling *Listeria*. This video provides workers with an overview of the organism, as well as practical steps that can be taken to control its growth in plant environments. Finally, the video leaves plant personnel with a powerful, resounding message: Teamwork and commitment are crucial in the production of safe, quality foods. (Silliker Laboratories–2000)

F2111 **Controlling *Salmonella*: Strategies That Work**–(13 minute videotape). This training video provides practical guidelines to prevent the growth of *Salmonella* in dry environments and avoid costly product recalls. Using this video as a discussion tool, supervisors can help employees learn about water and how it fosters conditions for the growth of *Salmonella* in dry processing plants with potentially devastating consequences. (Silliker Labs– 2002)

F2037 **Cooking and Cooling of Meat and Poultry Products**–(2 videotapes – 176 minutes). (See Part 1 Tape F2035 and Part 2 Tape F2036). This is session 3 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon completion of viewing these videotapes, the viewer will be able to (1) recognize inadequate processes associated with the cooking and cooling of meat and poultry at the retail level; (2) Discuss the hazards associated with foods and the cooking and cooling processes with management at the retail level; (3) Determine the adequacy of control methods to prevent microbiological hazards in cooking and cooling at the retail level, and (4) Understand the principle for determining temperature with various temperature measuring devices. (AFDO/USDA–1999)

F2030 **"Egg Games" Foodservice Egg Handling and Safety**–(18 minute videotape). Develop an effective egg handling and safety program that is right for your operation. Ideal for manager training and foodservice educational programs, this video provides step-by-step information in an entertaining, visually-exciting format. (American Egg Board–1999)

F2020 **Egg Handling & Safety**–(11 minute videotape). Provides basic guidelines for handling fresh eggs which could be useful in training regulatory and industry personnel. (American Egg Board–1997)

F2036 **Emerging Pathogens and Grinding and Cooking Comminuted Beef**–(2 videotapes – 165 minutes.) (See Part 1 Tape F2035 and Part 3 Tape F2037.) This is session 2 of a 3-part Meat and Poultry Teleconference co-sponsored by AFDO and the USDA Food Safety Inspection Service. These videotapes present an action plan for federal, state, local authorities, industry, and trade associations in a foodborne outbreak. (AFDO/USDA–1998)

F2035 **Fabrication and Curing of Meat and Poultry Products**–(2 videotapes – 145 minutes). (See Part 2 Tape F2036 and Part 3 Tape F2037). This is session 1 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon viewing, the sanitarian will be able to (1) Identify typical equipment used for meat and poultry fabrication at retail and understand their uses; (2) Define specific terms used in fabrication of meat and poultry products in retail establishments, and (3) Identify specific food safety hazards associated with fabrication and their controls. (AFDO/USDA–1997)

FastTrack Restaurant Video Kit–These five short, direct videos can help make your employees more aware of various food hazards and how they can promote food safety. (DiverseyLever/American Hotel & Lodging Educational Institute – 1994)

F2500 **Tape 1–Food Safety Essentials**–(23 minute videotape). This video provides an overview of food safety. All food service employees learn six crucial guidelines for combating foodborne illness. Prepares employees for further position-specific training to apply the six food safety principles to specific jobs.

F2501 **Tape 2–Receiving and Storage**–(22 minute videotape). Make sure only safe food enters your doors! Receiving and storage staff learn what to look for and how to prevent spoilage with proper storage with this video.

F2502 **Tape 3–Service**–(22 minute videotape). Servers are your last safety checkpoint before guests receive food. This video helps you make sure they know the danger signs.

F2503 **Tape 4–Food Production**–(24 minute videotape). Food production tasks cause most food safety problems. Attack dangerous practices at this critical stage with this video training tool.

F2504 **Tape 5–Warewashing**–(21 minute videotape). Proper sanitation starts with clean dishes! With this video, warewashers will learn how to ensure safe tableware for guests and safe kitchenware for coworkers.

F2039 **Food for Thought–The GMP Quiz Show**–(16 minute videotape). In the grand tradition of television quiz shows, three food industry workers test their knowledge of GMP principles. As the contestants jockey to answer questions, the video provides a thorough and timely review of GMP principles. This video is a cost-effective tool to train new hires or sharpen the knowledge of veteran employees. Topics covered include employee practices, including proper attire, contamination, stock rotation, pest control, conditions for microbial growth and employee traffic patterns. Food safety terms such as HACCP, microbial growth niche, temperature danger zone, FIFO and cross-contamination, are also defined. (Silliker Laboratories–2000)

F2040 **Food Irradiation**–(30 minute videotape). Introduces viewers to food irradiation as a new preservation technique. Illustrates how food irradiation can be used to prevent spoilage by microorganisms, destruction by insects, overripening, and to reduce the need for chemical food additives. The food irradiation process is explained and benefits of the process are highlighted. (Turnelle Productions, Inc.) (Reviewed 1998)

F2045 **Food Microbiological Control**–(6-videotapes – approximate time 12 hours). Designed to provide information and demonstrate the application of basic microbiology, the Good Manufacturing Practices (GMPs), retail Food Code, and sanitation practices when conducting food inspections at the processing and retail levels. Viewers will enhance their ability to identify potential food hazards and evaluate the adequacy of proper control methods for these hazards. (FDA–1998)

F2050 **Food Safe–Food Smart–HACCP & Its Application to the Food Industry**–(2-16 minute videotapes). (1)–Introduces the seven principles of HACCP and their application to the food industry. Viewers will learn about the HACCP system and how it is used in the food industry to provide a safe food supply. (2)–Provides guidance on how to design and implement a HACCP system. It is intended for individuals with the responsibility of setting up a HACCP system. (Alberta Agriculture, Food and Rural Development) (Reviewed 1998)

F2060 **Food Safe–Series I**–(4-10 minute videotapes). (1) "Receiving & Storing Food Safely," details for foodservice workers the procedures for performing sight inspections for the general conditions of food, including a discussion of food labeling and government approval stamps. (2) "Food-service Facilities and Equipment," outlines the requirements for the proper cleaning and sanitizing of equipment used in food preparation areas. Describes the type of materials, design, and proper maintenance of this equipment. (3) "Microbiology for Foodservice Workers," provides a basic understanding of the microorganisms which cause food spoilage and foodborne illness. This program describes bacteria, viruses, protozoa, and parasites and the conditions which support their growth. (4) "Food-service Housekeeping and Pest Control," emphasizes cleanliness as the basis for all pest control. Viewers learn the habits and life cycles of flies, cockroaches, rats, and mice. (Perennial Education–1991) (Reviewed 1998)

F2070 **Food Safe–Series II**–(4-10 minute videotapes). Presents case histories of foodborne disease involving (1) *Staphylococcus aureus*, (sauces) (2) *Salmonella*, (eggs) (3) *Campylobacter*, and (4) *Clostridium botulinum*. Each tape demonstrates errors in preparation, holding or serving food; describes the consequences of those actions; reviews the procedures to reveal the cause of the illness; and illustrates the correct practices in a step-by-step demonstration. These are excellent tapes to use in conjunction with hazard analysis critical control point training programs. (Perennial Education–1991) (Reviewed 1998)

F2080 **Food Safe–Series III**–(4-10 minute videotapes). More case histories of foodborne disease. This set includes (1) Hepatitis "A", (2) *Staphylococcus aureus* (meats), (3) *Bacillus cereus*, and (4) *Salmonella* (meat). Viewers will learn typical errors in the preparation, holding and serving of food. Also included are examples of correct procedures which will reduce the risk of food contamination. (Perennial Education–1991) (Reviewed 1998)

F2133 **Food Safety First**–(50 minute videotape). This food safety training video presents causes of foodborne illness in foodservice and ways to prevent foodborne illness. Individual segments include personal hygiene and handwashing, cleaning and sanitizing, preventing cross contamination and avoiding time and temperature abuse. Foodhandling principles are presented through scenarios in a restaurant kitchen. (Glo-Germ 1998). Available in Spanish.

F2090 **Food Safety: An Educational Video for Institutional Food Service Workers**–(10 minute videotape). Provides a general discussion on food safety principles with special emphasis on pathogen reductions in an institutional setting from child care centers to nursing homes. (US Department of Health & Human Services–1997)

Food Safety for Food Service Series I–An employee video series containing quick, 10-minute videos that

teach food service employees how to prevent foodborne illness. This four video series examines sources of foodborne illness, plus explores prevention through awareness and recommendations for best practices for food safety. It also looks at how food safety affects the food service employee's job. (J.J. Keller & Associates–2000)

F2100 **Tape 1–Food Safety for Food Service: Cross Contamination**–(10 minute videotape). Provides the basic information needed to ensure integrity and safety in foodservice operations. Explains proper practices and procedures to prevent, detect and eliminate cross contamination.

F2101 **Tape 2–Food Safety for Food Service: HACCP**–(10 minute videotape). This video takes the mystery out of HACCP for your employees, and explains the importance of HACCP procedures in their work. Employees will come away feeling confident, knowing how to make HACCP work. The seven steps of HACCP and how HACCP is used in foodservice are some of the topics discussed.

F2102 **Tape 3–Food Safety for Food Service: Personal Hygiene**–(10 minute videotape). This video establishes clear, understandable ground rules for good personal hygiene in the foodservice workplace and explains why personal hygiene is so important. Topics include: personal cleanliness; proper protective equipment; correct hand washing procedures; when to wash hands, hygiene with respect to cross contamination and prohibited practices and habits.

F2103 **Tape 4–Food Safety for Food Service: Time and Temperature Controls**–(10 minute videotape). This video examines storage and handling of raw and cooked ingredients, and explains how to ensure their safety. Employees learn how to spot potential problems and what to do when they find them. Topics include: correct thermometer use, cooling, thawing and heating procedures, food storage procedures, holding temperature requirements, and handling leftovers.

Food Safety for Food Service Series II–An employee video series containing quick, 10-minute videos that boost safety awareness for food service employees and teach them how to avoid foodborne illness. (J. J. Keller & Associates, Neenah, WI– 2002)

F2104 **Tape 1–Basic Microbiology and Foodborne Illness**–(10 minute videotape). Covers four common microorganisms in food, how they get into food, and simple ways to prevent contamination. Stresses the importance of keeping food at the right temperature, having proper personal hygiene, and cleaning and sanitizing work surfaces.

F2105 **Tape 2–Handling Knives, Cuts and Burns**–(10 minute videotape). Explains why sharp knives are safer than dull ones, provides tips for selecting a good knife, and gives techniques for cutting food safely. Also explains first aid for cuts and burns and the most common causes of burns.

F2106 **Tape 3–Working Safely to Prevent Injury**–(10 minute videotape). Discusses common lifting hazards and how back injuries can happen. Gives proper lifting and carrying techniques to prevent soreness and injury. Also covers how to prevent slips, trips, and falls.

F2107 **Tape 4–Sanitation**–(10 minute videotape). Provides tips for good personal hygiene habits, including the proper way to wash your hands, dress, and prepare for work. Also covers cleaning and sanitizing equipment; storing chemicals and cleaning supplies; and controlling pests that can contaminate work areas and food.

F2120 **Food Safety: For Goodness Sake, Keep Food Safe**–(15 minute videotape). Teaches foodhandlers the fundamentals of safe food handling. The tape features the key elements of cleanliness and sanitation, including: good personal hygiene, maintaining proper food product temperature, preventing time abuse, and potential sources of food contamination. (Iowa State University Extension–1990) (Reviewed 1998)

F2110 **Food Safety is No Mystery**–(34 minute videotape). This is an excellent training visual for foodservice workers. It shows the proper ways to prepare, handle, serve and store food in actual restaurant, school and hospital situations. A policeman sick from food poisoning, a health department sanitarian, and a food-service worker with all the bad habits are featured. The latest recommendations on personal hygiene, temperatures, cross-contamination, and storage of foods are included. (USDA–1987). Also available in Spanish. – (Reviewed 1998)

F2129 **Food Technology: Irradiation** – (29 minute videotape). Video covers the following issues: history and details of the irradiation process; effects of irradiation on treated products, and consumer concerns and acceptance trends. Other important concerns addressed include how food irradiation affects food cost, the nutritional food industry, food science and research, and irradiation regulatory industries (such as the Nuclear Regulatory Commission) add insight into the process of irradiation. (Chipbooks– 2001)

F2130 **Food Safety: You Make the Difference**–(28 minute videotape). Through five food workers from differing backgrounds, this engaging and inspirational documentary style video illustrates the four basic food safety concepts: handwashing, preventing cross-contamination, moving foods quickly through the danger zone, and hot/cold holding (Seattle-King County Health Department–1995)

Food Safety Zone Video Series–A one-of-a-kind series that helps get your employees to take food safety issues seriously! These short, to-the-point videos can help make your employees aware of various food hazards, and how they can help promote food safety. The 4 topics are: Basic Microbiology, Cross Contamination, Personal Hygiene, and Sanitation. (J.J. Keller & Associates – 1999). (Also available in Spanish.)

F2125 **Tape 1–Food Safety Zone: Basic Microbiology**–(10 minute videotape). In this video, food service personnel will gain a deeper understanding of food safety issues and what they can do to prevent recalls and contamination. It describes the different types of bacteria that can be harmful to food, and tells how to minimize bacterial growth through time and temperature controls, personal hygiene practices, and sanitation.

F2126 **Tape 2–Food Safety Zone: Cross Contamination**–(10 minute videotape). Quickly teach your employees how they can help prevent cross contamination. Employees are educated on why contaminants can be extremely dangerous, cause serious injury, and even death, to consumers of their food products. This fast-paced video will give your employees a deeper understanding of the different types of cross contamination, how to prevent it, and how to detect it through visual inspections and equipment. The emphasis is that prevention is the key to eliminating cross contamination.

F2127 **Tape 3–Food Safety Zone: Personal Hygiene**–(10 minute videotape). After watching this video, your employees will understand why their personal hygiene is critical to the success of your business. This video teaches employees about four basic good personal hygiene practices: keeping themselves clean, wearing clean clothes, following specific hand washing procedures, and complying with all related work practices. Personnel are also taught that personal hygiene practices are designed to prevent them from accidentally introducing bacteria to food products, and are so important that there are federal laws that all food handlers must obey.

F2128 **Tape 4–Food Safety Zone: Sanitation**–(10 minute videotape). Don't just tell your employees why sanitation is important, show them! This training video teaches employees about the sanitation procedures that cover all practices to keep workplaces clean, and food produced free of contaminants and harmful bacteria. Four areas covered include personal hygiene, equipment and work areas, use and storage of cleaning chemicals and equipment, and pest control.

F2135 **Get with a Safe Food Attitude**–(40 minute videotape). Consisting of nine short segments which can be viewed individually or as a group, this video presents safe food handling for moms-to-be. Any illness a pregnant woman contracts can affect her unborn child whose immune system is too immature to fight back. The video follows four pregnant women as they learn about food safety and preventing foodborne illness. (US Department of Agriculture–1999)

F2136 **GLP Basics: Safety in the Food Micro Lab**–(16 minute videotape). This video is designed to teach laboratory technicians basic safety fundamentals and how to protect themselves from inherent workplace dangers. Special sections on general laboratory rules, personal protective equipment, microbiological, chemical, and physical hazards, autoclave safety, and spill containment are featured. (Silliker Laboratories Group, Inc., Homewood, IL–2001)

F2137 **GMP Basics: Avoiding Microbial Cross-Contamination**–(15 minute videotape). This video takes a closer look at how harmful microorganisms, such as *Listeria*, can be transferred to finished products. Employees see numerous examples of how microbial cross-contamination can occur from improper traffic patterns, poor personal hygiene, soiled clothing, unsanitized tools and equipment. Employees need specific knowledge and practical training to avoid microbial cross-contamination in plants. This video aids in that training. (Silliker Laboratories–2000)

F2140 **GMP Basics – Employee Hygiene Practices**–(20 minute videotape). Through real-life examples and dramatization, this video demonstrates good manufacturing practices that relate to employee hygiene, particularly hand washing. This video includes a unique test section to help assess participants' understanding of common GMP violations. (Silliker Laboratories–1997)

F2143 **GMP Basics: Guidelines for Maintenance Personnel**–(21 minute videotape). Developed specifically for maintenance personnel working in a food processing environment, this video depicts a plant-wide training initiative following a product recall announcement. Maintenance personnel will learn how GMPs relate to their daily activities and how important their roles are in the production of safe food products. (Silliker Laboratories–1999)

F2148 **GMP–GSP Employee**–(38 minute videotape). This video was developed to teach food plant employees the importance of "Good Manufacturing Practices" and "Good Sanitation Practices." Law dictates that food must be clean and safe to eat. This video emphasizes the significance of each employee's role in protecting food against contamination. Tips on personal cleanliness and hygiene are also presented. (L.J. Bianco & Associates)

F2150 **GMP: Personal Hygiene & Practices in Food Manufacturing**–(14 minute videotape). This video focuses on the personal hygiene of food-manufacturing workers, and explores how poor hygiene habits can be responsible for the contamination of

food in the manufacturing process. This is an instructional tool for new food-manufacturing line employees and supervisors. It was produced with "real" people in actual plant situations, with only one line of text included in the videotape. (Penn State–1993)–(Available in Spanish and Vietnamese)

F2147 **GMP Basics: Process Control Practices**–(16 minute videotape). In actual food processing environments, an on-camera host takes employees through a typical food plant as they learn the importance of monitoring and controlling key points in the manufacturing process. Beginning with receiving and storing, through production, and ending with packaging and distribution, control measures are introduced, demonstrated, and reviewed. Employees will see how their everyday activities in the plant have an impact on product safety. (Silliker Laboratories–1999)

GMP Food Safety Video Series–This five-part video series begins with an introduction to GMPs and definitions, then goes on to review specific sections of the GMPs: personnel, plant and grounds, sanitary operations, equipment and utensils, process and controls, warehousing, and distribution. Developed to assist food processors in training employees on personnel policies and Good Manufacturing Practices (GMPs), the series includes different types of facilities, including dairy plants, canning factories, pasta plants, bakeries, and frozen food manufacturing facilities. (J.J. Keller– 2003)

F2151 **Tape 1–Definitions**–(11:40 minute videotape). Provides the definitions necessary to understand the meaning of the GMPs.

F2152 **Tape 2–Personnel and Personnel Facilities**–(11:20 minute videotape). Covers selection of personnel, delegation of responsibilities, development of plant policies for employees, and operational practices.

F2153 **Tape 3–Building and Facilities**–(15:50 minute videotape). Discusses guidelines for the construction and maintenance of the manufacturing plant and grounds around the plant.

F2154 **Tape 4–Equipment and Utensils**–(12:30 minute videotape). Provides guidelines for the construction, installation, and maintenance of processing equipment.

F2155 **Tape 5–Production and Process Controls**–(20 minute videotape). Covers establishing a food safety committee, in-house inspections, analysis of raw materials and ingredients, cleaning schedules and procedures, and more.

F2160 **GMP: Sources & Control of Contamination during Processing**–(20 minute videotape). This program, designed as an instructional tool for new employees and for refresher training for current or reassigned workers, focuses on the sources and control of contamination in the food-manufacturing process. It was produced in actual food plant situations. A concise description of microbial contamination and growth and cross-contamination, a demonstration of food storage, and a review of aerosol contaminants are also included. (Penn State–1995)

GMPs for Food Plant Employees; 5 volume video series based on European standards and regulations–Developed to assist food processors in training employees in the Good Manufacturing Practices. Examples are drawn from a variety of processing facilities including dairy plants, canning facilities, pasta plants, bakeries, frozen food facilities, etc. (AIB International– 2003)

F2161 **Tape 1–Definitions**–(13 minute videotape). Begins with an introduction to the GMPs and traces a basic history of food laws in Europe, ending with the EC Directive 93/43/EEC of June 1993 on the hygiene of foodstuffs.

F2162 **Tape 2–Personnel and Personnel Practices**–(13 minute videotape). Selecting personnel, delegating responsibilities, developing plant policies for employees and visitors, and establishing operational practices.

F2163 **Tape 3–Building and Facilities**–(17 minute videotape). Guidelines for the construction and maintenance of the manufacturing facility and grounds around the factory.

F2164 **Tape 4–Equipment and Utensils**–(13 minute videotape). Guidelines for construction, installation, and maintenance of processing equipment.

F2165 **Tape 5–Production/Process Controls**–(22 minute videotape). Covers production and process controls, establishing a food safety committee, conducting in-house inspections, analyzing raw materials and ingredients, developing operational methods, establishing cleaning schedules and procedures, creating pest control programs and record keeping.

F2180 **HACCP: Safe Food Handling Techniques**–(22 minute videotape). The video highlights the primary causes of food poisoning and emphasizes the importance of self-inspection. An explanation of potentially hazardous foods, cross-contamination, and temperature control is provided. The main focus is a detailed description of how to implement a Hazard Analysis Critical Control Point (HACCP) program in a food-service operation. A leader's guide is provided as an adjunct to the tape. (The Canadian Restaurant & Foodservices Association–1990) (Reviewed 1998)

F2169 **HACCP: Training for Employees — USDA Awareness**–(15 minute videotape). This video is a detailed training outline provided for the employee program. Included in the video is a synopsis of general federal regulations; HACCP plan development; incorporation of HACCP's seven principles; HACCP plan checklist, and an HACCP employee training program. (J.J. Keller & Associates–1999)

F2172 **HACCP: Training for Managers**–(17 minute videotape). Through industry-specific examples and case studies, this video addresses the seven HACCP steps, identifying critical control points, recordkeeping and documentation, auditing, and

monitoring. It also explains how HACCP relates to other programs such as Good Manufacturing Practices and plant sanitation. (J.J. Keller & Associates, Inc.–2000)

F2170 **The Heart of HACCP**–(22 minute videotape). A training video designed to give plant personnel a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to their own work environment. This video emphasizes the principles of primary concern to plant personnel such as critical limits, monitoring systems, and corrective actions that are vital to the success of a HACCP plan. (Silliker Laboratories Group–1994)

F2171 **HACCP: The Way to Food Safety**–(53 minute videotape). The video highlights the primary causes of food poisoning and stresses the importance of self-inspection. Potentially hazardous foods, cross-contamination and temperature control are explained. The video is designed to give a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to a work environment. Critical limits, monitoring systems and corrective action plans are emphasized. The video also provides an overview of foodborne pathogens, covering terminology, the impact of pathogens, and what employees must do to avoid problems. Also described are the sources, causes and dangers of contamination in the food industry. (Southern Illinois University–1997)

F2173 **Inside HACCP: Principles, Practices & Results**–(15 minute videotape). This video is designed to help you build a more knowledgeable work-force and meet safety standards through a comprehensive overview of HACCP principles. Employees are provided with details of prerequisite programs and a clear overview of the seven HACCP principles. "Inside HACCP" provides short succinct explanations of how HACCP works and places special emphasis on the four principles —monitoring, verification, corrective action, and recordkeeping – in which employees actively participate. (Silliker Laboratories Group, Inc., Homewood, IL–2001)

F2175 **Inspecting For Food Safety–Kentucky's Food Code**–(100 minute videotape). Kentucky's Food Code is patterned after the Federal Food Code. The concepts, definitions, procedures, and regulatory standards included in the code are based on the most current information about how to prevent foodborne diseases. This video is designed to prepare food safety inspectors to effectively use the new food code in the performance of their duties. (Department of Public Health Commonwealth of Kentucky–1997) (Reviewed 1999)

F2190 **Is What You Order What You Get? Seafood Integrity**–(18 minute videotape). Teaches seafood department employees about seafood safety and how they can help insure the integrity of seafood sold by retail food markets. Key points of interest are cross-contamination control, methods and criteria for receiving seafood and determining product quality, and knowing how to identify fish and seafood when unapproved substitutions have been made. (The Food Marketing Institute) (Reviewed 1998)

F2210 **Northern Delight–From Canada to the World**–(13 minute videotape). A promotional video that explores the wide variety of foods and beverages produced by the Canadian food industry. General in nature, this tape presents an overview of Canada's food industry and its contribution to the world's food supply. (Ternelle Production, Ltd.) (Reviewed 1998)

F2240 **On the Front Line**–(18 minute videotape). A training video pertaining to sanitation fundamentals for vending service personnel. Standard cleaning and serving procedures for cold food, hot beverage and cup drink vending machines are presented. The video emphasizes specific cleaning and serving practices which are important to food and beverage vending operations. (National Automatic Merchandising Association–1993) (Reviewed 1998)

F2250 **On the Line**–(30 minute videotape). This was developed by the Food Processors Institute for training food processing plant employees. It creates an awareness of quality control and regulations. Emphasis is on personal hygiene, equipment cleanliness and good housekeeping in a food plant. It is recommended for showing to both new and experienced workers. (Available in Spanish) The Food Processors Institute. 1993. (Reviewed 1998)

F2270 **Pest Control in Seafood Processing Plants**–(26 minute videotape). Videotape which covers procedures to control flies, roaches, mice, rats and other common pests associated with food processing operations. The tape will familiarize plant personnel with the basic characteristics of these pests and the potential hazards associated with their presence in food operations. (Reviewed 1998)

F2280 **Principles of Warehouse Sanitation**–(33 minute videotape). This videotape gives a clear, concise and complete illustration of the principles set down in the Food, Drug and Cosmetic Act and in the Good Manufacturing Practices, as well as supporting legislation by individual states. (American Institute of Baking–1993)

F2271 **Preventing Foodborne Illness**–(10 minute videotape). This narrated video is for food service workers, with emphasis on insuring food safety by washing one's hands before handling food, after using the bathroom, sneezing, touching raw meats and poultry, and before and after handling foods such as salads and sandwiches. Safe food temperatures and cross contamination are also explained. (Colorado Dept. of Public Health and Environment– 1999)

F2290 **Product Safety & Shelf Life**–(40 minute videotape). Developed by Borden Inc., this videotape was done in three sections with opportunity for review. Emphasis is on providing consumers with good products. One section covers off-flavors, another product problems caused by plant conditions, and a third the need to keep products cold and fresh. Procedures to assure this are outlined, as shown in a plant. Well done and directed to plant workers and supervisors. (Borden–1987) – (Reviewed 1997)

F2220 **Proper Handling of Peracidic Acid**–(15 minute videotape). Introduces paracidic acid as a chemical sanitizer and features the various precautions needed to use the product safely in the food industry.

F2230 **Purely Coincidental**–(20 minute videotape). A parody that shows how foodborne illness can adversely affect the lives of families that are involved. The movie compares improper handling of dog food in a manufacturing plant that causes the death of a family pet with improper handling of human food in a manufacturing plant that causes a child to become ill. Both cases illustrate how handling errors in food production can produce devastating outcomes. (The Quaker Oats Company–1993.) (Reviewed 1998)

F2310 **Safe Food: You Can Make a Difference**–(25 minute videotape). A training video for foodservice workers which covers the fundamentals of food safety. An explanation of proper food temperature, food storage, cross-contamination control, cleaning and sanitizing, and handwashing as methods of foodborne illness control is provided. The video provides an orientation to food safety for professional foodhandlers. (Tacoma–Pierce County Health Department–1990). (Reviewed 1998)

F2320 **Safe Handwashing**–(15 minute videotape). Twenty-five percent of all foodborne illnesses are traced to improper handwashing. The problem is not just that handwashing is not done, the problem is that it's not done properly. This training video demonstrates the "double wash" technique developed by Dr. O. Peter Snyder of the Hospitality Institute for Technology and Management. Dr. Snyder demonstrates the procedure while reinforcing the microbiological reasons for keeping hands clean. (Hospitality Institute for Technology and Management–1991) (Reviewed 1998)

F2325 **Safe Practices for Sausage Production**–(3 hour videotape). This videotape is based on a series of educational broadcasts on meat and poultry inspections at retail food establishments produced by the Association of Food and Drug Officials (AFDO) and USDA's Food Safety and Inspection Service (FSIS), along with FDA's Center for Food Safety and Applied Nutrition. The purpose of the broadcast was to provide training to state, local, and tribal sanitarians on processes and procedures that are being utilized by retail stores and restaurants, especially those that were usually seen in USDA-inspected facilities. The program will cover the main production steps of sausage products, such as the processes of grinding, stuffing, and smoking, and typical equipment used will be depicted. Characteristics of different types of sausage (fresh, cooked and smoked, and dry/semi-dry) will be explained. Pathogens of concern and outbreaks associated with sausage will be discussed. The written manual for the program is available at www.fsis.usda.gov/ofo/hrds/STATE/RETAIL/manual.htm. (1999)

F2460 **Safer Processing of Sprouts**–(1 hour and 22 minute videotape). Sprouts are enjoyed by many consumers for their taste and nutritional value. However, recent outbreaks of illnesses associated with sprouts have demonstrated a potentially serious human health risk posed by this food. FDA and other public health officials are working with industry to identify and implement production practices that will assure that seed and sprouted seed are produced under safe conditions. This training video covers safe processing practices of sprouts including growing, harvesting, milling, transportation, storage, seed treatment, cleaning and sanitizing, sampling and microbiological testing. (CA Dept. of Health Services, Food and Drug Branch; U.S. Food and Drug Administration, and the Centers for Disease Control and Prevention – 2000)

F2330 **Sanitation for Seafood Processing Personnel**–(20 minute videotape). A training video suited for professional foodhandlers working in any type of food manufacturing plant. The film highlights Good Manufacturing Practices and their role in assuring food safety. The professional foodhandler is introduced to a variety of sanitation topics including: (1) foodhandlers as a source of food contamination, (2) personal hygiene as a means of preventing food contamination, (3) approved food storage techniques including safe storage temperatures, (4) sources of cross-contamination, (5) contamination of food by insects and rodents, (6) garbage handling and pest control, and (7) design and location of equipment and physical facilities to facilitate cleaning. (Reviewed 1998)

F2340 **Sanitizing for Safety**–(17 minute videotape). Provides an introduction to basic food safety for professional foodhandlers. A training pamphlet and quiz accompany the tape. Although produced by a chemical supplier, the tape contains minimal commercialism and may be a valuable tool for training new employees in the food industry. (Clorox–1990) (Reviewed 1998)

F2341 **Science and Our Food Supply**–(45 minute videotape). Becoming food safety savvy is as easy as A-B-C! This video includes step-by-step journey food travels from the farm to the table; the Fight BAC!™ Campaign's four simple steps to food safety, clean, cook, separate (combat cross contamination), and chill, and the latest in food safety careers. Other topics covered include understanding bacteria, food processing and transportation, and the future technology of food processing. (FDA-Center for Food Safety and Applied Nutrition–2001)

F2350 **ServSafe® Steps to Food Safety**–The ServSafe food safety series consists of six videos that illustrate and reinforce important food safety practices in an informative and entertaining manner. The videos provide realistic scenarios in multiple industry segments. English and Spanish are provided on each tape. (National Restaurant Association Education Foundation –2000)

Step One: Starting Out with Food Safety–(12 minute videotape). Defines what foodborne illness is and how it occurs; how foods become unsafe; and what safety practices to follow during the flow of food.

Step Two: Ensuring Proper Personal Hygiene–(10 minute videotape). Introduces employees to ways they might contaminate food; personal cleanliness practices that help protect food; and the procedure for thorough handwashing.

Step Three: Purchasing, Receiving and Storage–(12 minute videotape). Explains how to choose a supplier; calibrate and use a thermometer properly; accept or reject a delivery; and store food safely.

Step Four: Preparing, Cooking, and Serving–(11 minute videotape). Identifies proper practices for thawing, cooking, holding, serving, cooling and reheating food.

Step Five: Cleaning and Sanitizing–(11 minute videotape). Describes the difference between cleaning and sanitizing; manual and machine warewashing; how sanitizers work; how to store clean items and cleaning supplies; and how to setup a cleaning program.

Step Six: Take the Food Safety Challenge: Good Practices, Bad Practices — You Make the Call!–(35 minute videotape). Challenges viewers to identify good and bad practices presented in five short scenarios from different industry segments.

F2430 **Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant**–(20 minute videotape). A practical training tool for new sanitation employees or as a refresher for veterans. Employees will understand the food safety impact of their day-to-day cleaning and sanitation activities and recognize the importance of their role in your company's food safety program. (Silliker Laboratories Group–1996)

F2370 **Supermarket Sanitation Program–"Cleaning & Sanitizing"**–(13 minute videotape). Contains a full range of cleaning and sanitizing information with minimal emphasis on product. Designed as a basic training program for supermarket managers and employees. (1989) (Reviewed 1998)

F2380 **Supermarket Sanitation Program–"Food Safety"**–(11 minute videotape). Contains a full range of basic sanitation information with minimal emphasis on product. Filmed in a supermarket, the video is designed as a basic program for manager training and a program to be used by managers to train employees. (1989) (Reviewed 1998)

F2390 **Take Aim at Sanitation**–(8 minute videotape). This video features tips on food safety and proper disposal of single service items. Also presented is an emphasis on food contact surfaces as well as the manufacture, storage and proper handling of these items. (Foodservice and Packaging Institute, Inc.–1995). (Available in Spanish)

F2410 **Wide World of Food Service Brushes**–(18 minute videotape). Discusses the importance of cleaning and sanitizing as a means to prevent and control foodborne illness. Special emphasis is given to proper cleaning and sanitizing procedures and the importance of having properly designed and constructed equipment (brushes) for food preparation and equipment cleaning operations. (1989) (Reviewed 1998)

F2420 **Your Health in Our Hands–Our Health in Yours**–(8 minute videotape). For professional foodhandlers, the tape covers the do's and don'ts of foodhandling as they relate to personal hygiene, temperature control, safe storage and proper sanitation. (Jupiter Video Production–1993). (Reviewed 1998)

OTHER

M4010 **Diet, Nutrition & Cancer**–(20 minute videotape). Investigates the relationship between a person's diet and the risk of developing cancer. The film describes the cancer development process and identifies various types of food believed to promote and/or inhibit cancer. The film also provides recommended dietary guidelines to prevent or greatly reduce the risk of certain types of cancer.

M4020 **Eating Defensively: Food Safety Advice for Persons with AIDS**–(15 minute videotape). While HIV infection and AIDS are not acquired by eating foods or drinking liquids, persons infected with the AIDS virus need to be concerned about what they eat. Foods can transmit bacteria and viruses capable of causing life-threatening illness to persons infected with AIDS. This video provides information for persons with AIDS on what foods to avoid and how to better handle and prepare foods. (FDA/CDC–1989)

M4030 **Ice: The Forgotten Food**–(14 minute videotape). This training video describes how ice is made and where the critical control points are in its manufacture, both in ice plants and in on-premises locations (convenience stores, etc.); it documents the potential for illness from contaminated ice and calls on government to enforce good manufacturing practices, especially in on-premises operations where sanitation deficiencies are common. (Packaged Ice Association–1993)

M4050 **Personal Hygiene & Sanitation for Food Processing Employees**–(15 minute videotape). Illustrates and describes the importance of good personal hygiene and sanitary practices for people working in a food processing plant. (Iowa State–1993)

M4060 **Psychiatric Aspects of Product Tampering**–(25 minute videotape). This was presented by Emanuel Tanay, M.D. from Detroit, at the fall 1986 conference of CSAFDA. He reviewed a few cases and then indicated that abnormal behavior is like a contagious disease. Media stories lead to up to 1,000 similar alleged cases, nearly all of which are false. Tamper-proof packaging and recalls are essential. Tampering and poisoning are characterized by variable motivation, fraud and greed. Law enforcement agencies have the final responsibilities. Tamper proof containers are not the ultimate answer. (1987)

M4070 **Tampering: The Issue Examined**–(37 minute videotape). Developed by Culbro Machine Systems, this videotape is well done. It is directed to food processors and not regulatory sanitarians or consumers. A number of industry and regulatory agency management explain why food and drug containers should be made tamper evident. (Culbro–1987)

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- ❒ D1040 Ether Extraction Method for Determination of Raw Milk
- ❒ D1060 Frozen Dairy Products
- ❒ D1070 The Gerber Butterfat Test
- ❒ D1080 High-Temperature, Short-Time Pasteurizer
- ❒ D1090 Managing Milking Quality
- ❒ D1100 Mastitis Prevention and Control
- ❒ D1105 Milk Hauler Training
- ❒ D1110 Milk Plant Sanitation: Chemical Solution
- ❒ D1120 Milk Processing Plant Inspection Procedures
- ❒ D1125 Ohio Bulk Milk Hauling
- ❒ D1130 Pasteurizer – Design and Regulation
- ❒ D1140 Pasteurizer – Operation
- ❒ D1150 Processing Fluid Milk (slides)

ENVIRONMENTAL

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- ❒ E3020 Acceptable Risks?
- ❒ E3030 Air Pollution: Indoor
- ❒ E3031 Allergy Beware
- ❒ E3040 Asbestos Awareness
- ❒ E3055 Effective Handwashing–Preventing Cross-Contamination in the Food Service Industry
- ❒ E3060 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)
- ❒ E3070 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)
- ❒ E3075 EPA: This is Superfund
- ❒ E3080 Fit to Drink
- ❒ E3110 Garbage: The Movie
- ❒ E3120 Global Warming: Hot Times Ahead
- ❒ E3130 Kentucky Public Swimming Pool & Bathing Facilities
- ❒ E3135 Plastic Recycling Today: A Growing Resource
- ❒ E3140 Putting Aside Pesticides
- ❒ E3150 Radon
- ❒ E3160 RCRA – Hazardous Waste
- ❒ E3161 The Kitchen Uncovered Orkin Sanitized EMP
- ❒ E3170 The New Superfund: What It is & How It Works–(1) Changes in the Remedial Process: Clean-up Standards & State Involvement Requirements
- ❒ E3180 The New Superfund: What It is & How It Works–(2) Changes in the Removal Process: Removal & Additional Program Requirements
- ❒ E3190 The New Superfund: What It is & How It Works – (3) Enforcement and Federal Facilities
- ❒ E3210 The New Superfund: What It is & How It Works - (4) Emergency Preparedness & Community Right-to-Know
- ❒ E3220 The New Superfund: What It is & How It Works – (5) Underground Storage Tank Trust Fund & Response Program
- ❒ E3230 The New Superfund: What It is & How It Works – (6) Research & Development/Closing Remarks
- ❒ E3240 Sink a Germ
- ❒ E3245 Wash Your Hands
- ❒ E3250 Waste Not: Reducing Hazardous Waste

FOOD

- ❒ F2260 100 Degrees of Doom...The Time & Temperature Caper
- ❒ F2450 A Guide to Making Safe Smoked Fish
- ❒ F2005 A Lot on the Line
- ❒ F2007 The Amazing World of Microorganisms
- ❒ F2008 A Recipe for Food Safety Success
- ❒ F2009 Basic Personnel Practices
- ❒ F2440 Cleaning & Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!
- ❒ F2010 Close Encounters of the Bird Kind
- ❒ F2015 Controlling *Listeria*: A Team Approach
- ❒ F2111 Controlling *Salmonella*: Strategies that Work
- ❒ F2037 Cooking and Cooling of Meat and Poultry Products (2 Videos)
- ❒ F2030 "Egg Games" Foodservice Egg Handling and Safety
- ❒ F2020 Egg Handling & Safety
- ❒ F2036 Emerging Pathogens and Grinding and Cooking Comminuted Beef (2 Videos)
- ❒ F2035 Fabrication and Curing of Meat and Poultry Products (2 Videos) *FastTrack Restaurant Video Kit*
- ❒ F2500 Tape 1–Food Safety Essentials
- ❒ F2501 Tape 2–Receiving and Storage
- ❒ F2502 Tape 3–Service
- ❒ F2503 Tape 4–Food Production
- ❒ F2504 Tape 5–Warewashing
- ❒ F2039 Food for Thought – The GMP Quiz Show
- ❒ F2040 Food Irradiation
- ❒ F2045 Food Microbiological Control (6 Videos)
- ❒ F2050 Food Safe – Food Smart – HACCP & Its Application to the Food Industry (Part 1&2)
- ❒ F2060 Food Safe – Series I (4 Videos)
- ❒ F2070 Food Safe – Series II (4 Videos)
- ❒ F2080 Food Safe – Series III (4 Videos)
- ❒ F2155 Food Safety First
- ❒ F2090 Food Safety: An Educational Video for Institutional Food Service Workers *Food Safety for Food Service – Series I*
- ❒ F2100 Tape 1–Cross Contamination
- ❒ F2101 Tape 2– HACCP
- ❒ F2102 Tape 3–Personal Hygiene
- ❒ F2103 Tape 4–Time and Temperature Controls *Food Safety for Food Service – Series II*
- ❒ F2104 Tape 1–Basic Microbiology and Foodborne Illness
- ❒ F2105 Tape 2– Handling Knives, Cuts and Burns
- ❒ F2106 Tape 3–Working Safely to Prevent Injury
- ❒ F2107 Tape 4–Sanitation
- ❒ F2120 Food Safety: For Goodness Sake, Keep Food Safe
- ❒ F2110 Food Safety is No Mystery
- ❒ F2130 Food Safety: You Make the Difference
- ❒ F2125 Food Safety Zone: Basic Microbiology
- ❒ F2126 Food Safety Zone: Cross Contamination
- ❒ F2127 Food Safety Zone: Personal Hygiene
- ❒ F2128 Food Safety Zone: Sanitation
- ❒ F2129 Food Technology: Irradiation
- ❒ F2135 Get with a Safe Food Attitude
- ❒ F2136 GLP Basics: Safety in the Food Micro Lab
- ❒ F2137 GMP Basics: Avoiding Microbial Cross-Contamination
- ❒ F2140 GMP Basics: Employee Hygiene Practices
- ❒ F2143 GMP Basics: Guidelines for Maintenance Personnel
- ❒ F2148 GMP – GSP Employee
- ❒ F2150 GMP: Personal Hygiene and Practices in Food Manufacturing
- ❒ F2147 GMP Basics: Process Control Practices *GMP Food Safety Video Services*
- ❒ F2151 Tape 1: Definitions
- ❒ F2152 Tape 2: Personnel and Personnel Facilities
- ❒ F2153 Tape 3: Building and Facilities
- ❒ F2154 Tape 4: Equipment and Utensils
- ❒ F2155 Tape 5: Production and Process Controls
- ❒ F2160 GMP: Sources & Control of Contamination during Processing *GMPs for Food Plant Employees: 5 Volume Video Series Based on European Standards and Regulations*
- ❒ F2161 Tape 1: Definitions
- ❒ F2161 Tape 2: Personnel and Personnel Facilities
- ❒ F2163 Tape 3: Building and Facilities
- ❒ F2164 Tape 4: Equipment and Utensils
- ❒ F2165 Tape 5: Production/Process Controls
- ❒ F2180 HACCP: Safe Food Handling Techniques
- ❒ F2169 HACCP:Training for Employees–USDA Awareness
- ❒ F2172 HACCP Training for Managers
- ❒ F2170 The Heart of HACCP
- ❒ F2171 HACCP: The Way to Food Safety
- ❒ F2173 Inside HACCP: Principles, Practices & Results
- ❒ F2175 Inspecting for Food Safety – Kentucky's Food Code
- ❒ F2190 Is What You Order What You Get? Seafood Integrity
- ❒ F2210 Northern Delight – From Canada to the World
- ❒ F2240 On the Front Line
- ❒ F2250 On the Line
- ❒ F2270 Pest Control in Seafood Processing Plants
- ❒ F2271 Preventing Foodborne Illness
- ❒ F2280 Principles of Warehouse Sanitation
- ❒ F2290 Product Safety & Shelf Life
- ❒ F2220 Proper Handling of Peracidic Acid
- ❒ F2230 Purely Coincidental
- ❒ F2310 Safe Food: You Can Make a Difference
- ❒ F2320 Safe Handwashing
- ❒ F2325 Safe Practices for Sausage Production
- ❒ F2460 Safer Processing of Sprouts
- ❒ F2330 Sanitation for Seafood Processing Personnel
- ❒ F2340 Sanitizing for Safety
- ❒ F2341 Science and Our Food Supply
- ❒ F2350 SERVSAFE® Steps to Food Safety (6 Videos)
- ❒ F2430 Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant
- ❒ F2370 Supermarket Sanitation Program – "Cleaning & Sanitizing"
- ❒ F2380 Supermarket Sanitation Program – "Food Safety"
- ❒ F2390 Take Aim at Sanitation
- ❒ F2410 Wide World of Food-Service Brushes
- ❒ F2420 Your Health in Our Hands – Our Health in Yours

OTHER

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- ❒ M4020 Eating Defensively: Food Safety Advice for Persons with AIDS
- ❒ M4030 Ice: The Forgotten Food
- ❒ M4050 Personal Hygiene & Sanitation for Food Processing Employees
- ❒ M4060 Psychiatric Aspects of Product Tampering
- ❒ M4070 Tampering: The Issue Examined

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QMC & S – Aces, Fort Lee

Dean C. Davidson
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David L. Kendall
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Joan C. Redder
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Dale D. Hancock
Washington State University
Pullman

WISCONSIN

Lindsey M. McDonnell
University of Wisconsin-Madison
Madison

Steven L. Wright
Verona

UPDATES

Hernandez Promoted to Vice President at NRAEF

Jorge Hernandez has been promoted to vice president of food safety and risk management with the National Restaurant Association's Educational Foundation (NRAEF). In this role, Hernandez will lead efforts to define NRAEF's food safety and risk management market offerings. In addition, he will maintain responsibility for NRAEF's science and regulatory relations team and will work with the National Restaurant Association on food safety, security and risk issues. Most recently, Hernandez was senior director of NRAEF's science and regulatory relations department. Prior to joining NRAEF, he worked as a food program coordinator and regional manager for the Illinois Department of Public Health.

Full Service Contract Laboratory Promotes Three Managers

Three members of the Q Laboratories, Inc. staff have been promoted to new positions within the organization. Joseph A. Cittadino has been named chemistry laboratory supervisor, and will oversee the everyday operations of the analytical lab as well as organizing and conducting special projects. Gregory L. Morris has been promoted to chemistry group leader, in charge of technical issues and continuity in the chemistry laboratory. John R. Lewis, Jr. has been named microbiology laboratory supervisor and will be responsible for administering research and development projects as well as assessing the continued direction of the microbiology department.

New Chief Executive for Food Science Australia

The Director of the UK's National Institute of Food Research (IFR), Professor Alastair Robertson, has been appointed chief executive of Australia's food processing research enterprise, Food Science Australia.

In addition to heading the IFR, Professor Robertson chairs the Institute of Grocery Distribution's Food Production Strategy Group, the Executive Board of the European SAFE Consortium and 'Foodforce' – a network of 25 directors of European food research organizations.

He is also a member of the UK Food Standards Agency Advisory Committee on Research, the Council of the Consumers' Association, the Food and Drink Federation's Food Research Policy Group, the University of Reading Board of Food Science and Technology and the Scientific Board of the EU-funded Centre of Excellence in Food Science for Central Europe.

Food Science Australia's multidisciplinary team of researchers use specialized facilities to develop innovative food processes and safe, value-added products. The team of 300 skilled people at sites in Sydney, Melbourne and Brisbane are committed to help make Australian food companies among the most competitive in the world.

Professor Robertson will replace Dr. Martin Cole who has been Food Science Australia's acting chief executive since the departure of Dr. Michael Eyles in April 2003. He will assume his new role at Food Science Australia in September.

Organic Valley Appoints New Sales Manager

Mark Zurek has joined the Organic Valley sales management team as the regional manager for the New York Metro, Philadelphia and Washington, D.C. markets.

In the food broker business for 22 years, Zurek most recently served as senior account manager of Paul G. Nester & Son Company. Prior to that post, he was a senior account executive with the Joseph W. Riley Company that became a part of Crossmark in 2000.

International Association for Food Protection® NEWS

Veneman Names Members to National Advisory Committee on Meat and Poultry Inspection

Agriculture Secretary Ann M. Veneman has named members to the National Advisory Committee on Meat and Poultry Inspection. "I am pleased these individuals have agreed to serve on this committee," said Veneman. "The members will provide valuable input into issues regarding meat and poultry inspection."

Members include: Ms. Deanna Baldwin, Maryland Department of Agriculture, Annapolis, MD; Dr. Gladys Bayse, Spelman College, Stone Mountain, GA; Dr. David Carpenter, Southern Illinois University, Springfield, IL; Ms. Charlotte Christin, Center for Science in the Public Interest, Washington, D.C.; Dr. James Denton, University of Arkansas, Fayetteville, AK; Mr. Kevin Elfering, Minnesota Department of Agriculture, St. Paul, MN; Ms. Sandra Eskin, AARP, Bethesda, MD; Mr. Michael Govro, Oregon Department of Agriculture, Lake Oswego, OR; Dr. Joseph J. Harris, Southwest Meat Association, College Station, TX; Dr. Jill Hollingsworth, Food Marketing Institute, Washington, D.C.; Dr. Lee C. Jan, Texas Department of Health, Austin, TX; Dr. Alice J. Johnson, National Turkey Federation, Washington, D.C.; Mr. Michael Kowalcyk, Safe Tables Our Priority, Mount Horeb, WI; Dr. Irene Leech, Virginia Citizens Consumer Council, Elliston, VA; Mr. Charles Link, Cargill Turkey Products, Mount Crawford, VA; Dr. Catherine Logue, North Dakota State University, Fargo, ND; and Mr. Mark Schad, Schad Meats, Inc., Cincinnati, OH.

Nominees to the committee are selected for a two-year term and no member may serve for more than three consecutive terms. Nine members of the current committee have been nominated to serve again.

3-A SSI Names New Certificants and Start Date for Verifications

Twenty-nine candidates passed the new certification exam given by 3-A Sanitary Standards Inc. (3-A SSI) to become the first 3-A Certified Conformance Evaluators (CCE). The new CCEs will undergo a special orientation session in late July before starting fieldwork. In the field, CCEs will determine whether equipment displaying the 3-A Symbol is manufactured in conformance to 3-A Standards.

The CCE credential was established by 3-A SSI as the central element of a new program to move 3-A Symbol authorization from self-certification to third party verification (TPV). The TPV program entails independent verification of conformance by an individual certified as a CCE by 3-A SSI. The verification will be required for equipment manufacturers or used equipment resellers to obtain or renew a 3-A Symbol.

"The new CCEs will assume responsibility for providing a service that will advance the high integrity of the 3-A Symbol and the positive reputation of 3-A SSI. They will bring substantial knowledge, experience and a valued professional reputation to this important mission," says 3-A SSI Executive Director Tim Rugh.

The new CCEs earned the certification following a rigorous evaluation process. All candidates were required to meet specific eligibility criteria, including a combination of basic education and industry experience in a setting where 3-A Standards were applied, as well as to provide references on their work experience and integrity. Candidates were required to pass a comprehensive written exam that tested their knowledge of principles of sanitary equipment design for 3-A equipment, the ability to interpret engineering drawings pertaining to manufacturing equipment and instrumentation for the food processing industries, and the ability to review and evaluate complex processes.

Prior to conducting actual field inspections, the new CCEs participated in an intensive TPV orientation program July 23-24 in Rosemont, IL.

"The orientation reinforced key attributes of the 3-A Standards, promoted consistency in the interpretation of 3-A Standards, and established a high level of uniformity between CCEs conducting TPV inspections," says chairman of the TPV coordinating committee Allen Sayler of the International Dairy Foods Association. "3-A SSI will also give practical administrative guidance on proper completion and submission of forms, deadlines and noncompliance reports."

A list of the new CCEs available for TPV consultation is posted on the 3-A Web site at www.3-a.org/protocols/cce.htm. For more information, contact Tim Rugh at 703.790.0295 or trugh@3-a.org.

3-A SSI Leadership Acts on Key Issues

The 3-A Sanitary Standards, Inc. (3-A SSI) Board of Directors met on May 14 in Milwaukee, WI and took action on a number of major issues, including:

- Nomination of 3-A Steering Committee Chair – Former USDA official F. Tracy Schonrock was nominated to chair the restructured 3-A Steering Committee. The structure and operations of the committee were changed in the formation of the new 3-A SSI. ADPI, IAFIS, IAFP, FDA/PHS and USDA designated voting representatives to the committee.
- 3-A SSI to Seek ANSI Accreditation – The Board approved a recommendation of the 3-A Steering Committee for 3-A SSI to seek accreditation as a standards developer organization by ANSI. ANSI is a non-profit organization that administers and coordinates the US voluntary standardization and conformity assessment system. ANSI Accreditation signifies that 3-A SSI procedures meet the requirements for due process and other key criteria for approval and withdrawal of American National Standards.
- 3-A SSI to Revamp Standards Development Process – The Board approved a related recommendation by the 3-A Steering Committee for 3-A SSI to recast the entire 3-A standards development process. The new procedures will be consistent with the essential requirements of ANSI for standards developers. A special drafting group of the 3-A Steering Committee meet at 3-A SSI June 24-25 to begin the work.
- Annual Meeting Format Under Review – The Board approved a recommendation of the Annual Meeting Coordinating Committee, chaired by Larry Hanson of Sani-Matic, Inc., to assess the entire content and format of the May meeting in Milwaukee. Input will be solicited on all aspects of the meeting, with the aim of implementing changes at the 2004 meeting.

More details on the 3-A Annual Meeting can be found on the 3-A website at www.3-a.org

IFPA President Announces Departure to Pursue New Challenges

The Board of Directors of the International Fresh-cut Product Association (IFPA) has announced that President Edith Garrett will leave the organization at the end of the year to pursue new professional and personal opportunities.

Garrett, who has held IFPA's top position since 1994, notified the Board of her decision prior to contract negotiations scheduled for later this summer. Garrett said she made the decision to leave IFPA after nearly 10 years to "start a fresh chapter in my life and explore new challenges, including the possibility of launching my own consulting business."

IFPA Board chairman Craig Delaney, executive vice president and chief financial officer of Ready Pac Produce, said the Board will immediately establish a committee to search for Garrett's replacement. Garrett will complete her current contract and continue serving as president until December 31, 2003.

Prior to joining IFPA, Garrett worked for eight years as the director of environment and quality assurance for South Bay Growers, Inc., a Florida lettuce and celery grower/shipper/processor. Garrett received a bachelor's degree in biology from the University of Tennessee, Knoxville and the Certified Association Executive (CAE) designation in 2002.

Irradiation Enhances Food Safety and Quality

Over 50 years of scientific research have established that the irradiation of foods to minimize foodborne illness and decrease waste is both safe and effective. Physicians and scientists associated with the American Council on Science and Health (ACSH) endorse the use of irradiation to enhance safety and supplement other food protection methods.

These and other facts about food irradiation are spelled out in the latest (fifth) edition of *Irradiated Foods*, a revised booklet published by ACSH and updated by Paisan Loaharanu, M.S. (former head of the food and environmental protection section of the Joint Division of Nuclear Techniques in Food and Agriculture of the FAO and IAEA, Vienna, Austria). The booklet explains the process of food irradiation, and provides answers to common consumer questions about it. "It is important that consumers understand that food irradiation is a safe process," states Dr. Ruth Kava, director of nutrition at ACSH. "Irradiation does not make food radioactive any more than a dental X-ray makes teeth radioactive."

The Centers for Disease Control (CDC) estimate that if half of the ground beef, pork, poultry, and processed luncheon meats in the United States were irradiated, there would be over 880,000 fewer cases of foodborne illness, 8,500 fewer hospitalizations, 6,660 fewer catastrophic illnesses, and 352 lives saved every year.

Irradiation can be used on foods in a number of ways. Typically, a low dose of radiation can be used to pasteurize foods such as meat, poultry, seafood, and spices in the same manner that heat is used to pasteurize milk, eliminating disease-causing organisms. Irradiation is meant to supplement—not replace—other methods of ensuring food safety. The safety of food irradiation has been studied more extensively than that of any other food preservation process, including canning, freezing, dehydration, and the use of chemical additives. Just as processing foods by other means (such as broiling) can create minute amounts of new chemicals, so can irradiation—but there is no evidence that trace amounts of these chemicals are hazardous for human consumption. Nor does irradiation of food pose a risk to workers in irradiation plants or to communities in which irradiation plants are located.

Irradiation has been approved for various applications by over 50 countries worldwide, as well as by the World Health Organization, the Food and Agriculture Organization of the United Nations, the American Medical Association, the American Dietetic Association, and the Institute of Food Technologists. As of March 2003, over 7,000 supermarkets and retail outlets in the US were selling irradiated ground beef.

According to ACSH president Dr. Elizabeth Whelan, "Food irradiation is a most valuable addition to our arsenal in the war against foodborne illnesses. The American consumer has much to gain and nothing to lose from the wider application of food irradiation to our food supply." Consumers can learn more about irradiation in the new edition of ACSH's *Irradiated Foods*.

New Tool on Tap for Fighting *Listeria*

A new tool could be at hand for "subtyping" strains of *Listeria monocytogenes* bacteria that cause foodborne illness, thanks to scientists with the Agricultural Research Service (ARS). Subtyping determines the strain affiliation of *Listeria* specimens isolated in the lab. This is critical to epidemiologists tracing outbreaks back to their source, as well as to government and industry efforts to safeguard food supplies through environmental monitoring, disinfection, sanitation and other measures. In the United States, listeriosis sickens an estimated 2,500 people annually, and kills 500. Of the bacterium's 13 known strains, serotypes 1/2a, 1/2b and 4b are chiefly to blame.

In Pullman, WA, ARS scientist Monica Borucki and Washington State University scientists Douglas Call and Thomas Besser devised a technique called mixed genome microarray analysis to examine *L. monocytogenes*' DNA for genes that differ among its strains. Identifying the genes will help the researchers learn why some strains cause disease epidemics, while others don't, and help them design subtyping methods for identifying the most pathogenic strains. These methods could then be used to check for genetic evidence of the strains in food, on farms or on food-processing equipment, according to Borucki, at ARS' Animal Disease Research Unit in Pullman.

In studies recently published in the *Journal of Clinical Microbiology*, the team extracted DNA fragments from 10 representative *Listeria* strains. They printed copies of them — in the form of hundreds of tiny dots, called microarray probes — onto special microarray slides. Next, they used fluorescence to label the DNA of the strains they wished to subtype, or genetically characterize. The labeled DNA was then applied to the slide, where it bound to probes with similar DNA. Computerized imaging software enabled the team to examine the slides for DNA illumination patterns signaling the presence of subtype-specific genes.

Eventually, the team hopes to parlay its microarray gene discoveries into a fast, standardized method of subtyping that public health labs can use to compare large amounts of data on strains that may cause local and/or national epidemics.

FDA and Bureau of Customs and Border Protection Announce Steps to Streamline Collection of Information on Food Imports

The US Food and Drug Administration (FDA) and the Bureau of Customs and Border Protection (CBP) have announced that they will streamline the implementation of the prior notice requirements of the Bioterrorism Act ("the Act") by allowing food importers to provide required information on food imports to both agencies using an integrated process.

Under the Act, importers will soon be required to provide "prior notice" about the content of their food imports to FDA, starting no later than December 12, 2003. Since the Act was passed last year, FDA and CBP have worked together to find ways to modify CBP's Automated Commercial System, currently used to obtain import information required by Customs.

As a result of this collaboration, importers, in most circumstances, will be able to provide the required information to FDA using this existing system, making it easier for them to comply with the new law.

Nearly 20% of all imports into the US are food and food products. Congress passed the Bioterrorism Act as part of its ongoing effort to combat terrorism — in this instance, by reducing the ability of international terrorists to carry out terrorist attacks in the United States by contaminating imported foods. The Act requires that FDA receive prior notice before food is imported or offered for import into the United States. The advance notice of import shipments will allow FDA and CBP to target import inspections more effectively and help protect the nation's food supply against terrorist acts and other public health emergencies.

"FDA is dedicated to its mission as one of the nation's frontline defenses against terrorism. Collaborating closely with CBP is one of the essential steps we are taking to improve the security of our the food supply against new threats, while minimizing the impact on imported foods," said Commissioner of Food and Drugs, Mark B. McClellan, M.D., Ph.D.

Created on March 1, 2003 as part of the new Department of Homeland Security, Customs and Border Protection combines all of the agencies with primary responsibility for the borders, including all 18,000 customs, immigration, and agriculture inspectors at more than 300 ports of entry into the United States. "The men and women of Customs and Border Protection are the guardians of our nation's borders," said CBP Commissioner Robert C. Bonner. "Our primary mission is keeping terrorists and terrorist weapons from entering the US. That is why we are partnering with the FDA to protect our nation against the potential of terrorists contaminating our imported food supply. And we are also partnering with the FDA to develop a system that will be less burdensome on the trade while at the same time fulfilling the mandates of the Bioterrorism Act."

FDA is reviewing the comments submitted on the proposed rule, published on February 3, 2003, and is preparing a final rule. The Act requires prior notice for imported food shipments beginning December 12, 2003. FDA anticipates publishing a final rule in early October.

Genetically Modified *E. coli* Produce Plant Product Used in Foods and Cosmetics, Science Study Says

Scientists engineered bacteria to produce bixin, a plant product used in many foods and cosmetics, after uncovering nature's genetic recipe for the pigment. Tomatoes capable of producing bixin, also known as annatto and used to add an orange touch to microwave popcorn and some cheeses, may arise from the advances reported in the June 27 issue of the journal, *Science*, published by AAAS, the science society.

This research may expand the supply of this economically important plant product used to add an orange touch to microwave popcorn and some cheeses, and texture and color to a variety of creams and cosmetics. Outside the laboratory, bixin is produced by a single, heavily-fruiting, small tropical tree, Bixa orellana.

First, the researchers figured out how the plant itself produces bixin. In addition to locating the three necessary genes, they demonstrated that lycopene is the physical precursor to bixin. Lycopene is the compound known to make tomatoes red.

Next, the authors moved to replicate this biosynthetic pathway in another organism. "We chose to start with *E. coli* because you can insert all the genes at once. Tomatoes will be more complicated," explained senior author Bilal Camara from CNRS and Université Louis Pasteur in Strasbourg, France. Bixin genes are not the only genetic ingredient. The scientists added these genes to *E. coli* already engineered to produce lycopene. When the *E. coli* growing in test tubes began to produce bixin, they did not change color because the lycopene had already turned these single-celled bacteria red. Lycopene is an antioxidant that gives foods such as tomatoes, watermelon and pink grapefruit their red color. It has made recent headlines as scientists investigate lycopene as a compound that may reduce the risk for some kinds of cancer.

The next step, according to Camara, is to insert the genes that produce this pigment into tomatoes, or other fruit that produce large amounts of lycopene naturally. "Tomatoes could become bixin factories," said Camara who explained that the three bixin genes would each have to be added to separate plants. These plants could be crossed to breed plants with the full complement of bixin genes. Alternatively, a vector allowing insertion of several genes could be used. Camara is hoping to have bixin-producing tomatoes in about two years. Camara explained why he is focused on harnessing the power of living organisms to produce bixin. "Living organisms can be engineered to constantly make the enzymes required for bixin synthesis. It's the best way," said Camara who explained that managing all the

enzymes in a non-biological synthesis scenario would be difficult. "The bixin produced in *E. coli* is exactly the same compound as the bixin harvested from the plant. There is no difference," said Camara. Throughout the tropical world, people grow the plants that produce bixin on plantations. Others harvest the red seed pods from wild plants. Bixin has been used by humans in such a wide range of products because it easily mixes and dissolves into both water-based and oil-based products destined for human consumption and human adornment. Indigenous tribes in the rainforests of South America have long used the seeds of Bixa orellana as a body paint and fabric dye. From Brazilian herbal medicine to jellies and soft drinks, the list of human uses for this yellow-orange pigment derived from the brilliantly red seed covers of Bixa orellana is long and varied.

Lycopene, the precursor to bixin, is a carotenoid. This class of compounds can be described as nature's advertisers. Scientists believe that lycopene's bright red color announces to the world that a tomato is ripe and ready consumption. The authors of this study have demonstrated how a tomato's advertisement (generated in *E. coli*) can be used to produce bixin, a colorful marketing tool of the plant Bixa orellana. And from this second advertisement, humans produce cosmetics — one of the social and sexual advertisments employed by humans.

Predictive Microbiology Database Launched

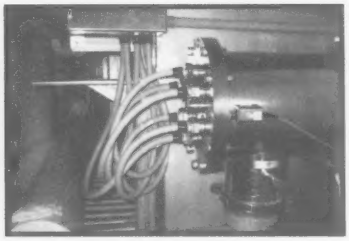
The US Dept. of Agriculture in an international collaboration with the UK Food Standards Agency have created an online database that contains the results of 20 years of experiments on the behavior of bacteria in foods. The online database, ComBase, was launched at the fourth International Conference for the Predictive Modelling of Foods, in Quimper, France. According to the project organizers, the database already contains around 20,000 growth and survival curves and 8,000 records containing growth rates. To access the database, see: www.ifr.ac.uk/combase/.

Crackdown on Water in Chicken Scam

New proposals from the Food Standards Agency to the European Commission recommend a cap on the amount of water that may be added to chicken, plus a ban on adding non-chicken proteins (such as beef and pork). Under the Agency's proposals, the amount of added water in chicken and poultry products would be limited to 15%. Beef and pork proteins are added to enable the product to hold very high levels of water, so if the amount of added water were limited to 15%, the need to add non-chicken proteins would be removed. However, to ensure such practices are stopped, the Agency is also proposing a ban on adding non-chicken proteins to chicken. Agency Chair Sir John Krebs said, "Under European law it is not illegal to add huge amounts of water or beef and pork proteins to chicken as long as this appears on the label. It may be legal but it doesn't make it acceptable. The only reason to add the proteins is to pump up the water to high levels – that's a recipe for ripping consumers off. That's why we consider that the amount of water that can be added to chicken should be limited and the use of non-chicken proteins banned." There are currently no legal limits on the amount of water that can be added to chicken and poultry products.

The suggested measures follow two surveys by the Agency in the UK (December 2001 and March 2003) that revealed some chicken pieces contained as much as 55% added water. In some cases, beef and pork proteins were used. The FSA surveys also revealed that many products were mislabelled and twenty local authorities are considering formal enforcement action against the relevant companies. Dutch authorities have reported that they have taken formal enforcement action against five companies processing chicken products in The Netherlands, which is at the centre of this industry.

INDUSTRY PRODUCTS



Aquionics

Aquionics' UV Disinfection Has Multiple Applications in Food Processing

Control of microbial contamination is a high priority for processors in the food industry. Driven by ever-higher quality standards, many operators are now turning to UV (ultraviolet) disinfection technology to help them meet their targets. UV disinfection can be applied to brine chillers, meat marinade and pickle injectors, air handling systems for packing plants, and treatment of plant wastewater for reuse.

UV light technology is widely used for wastewater, water, surface and air purification processes. By exposing microorganisms to a specific dose and intensity of UV light, for a given time, the reproductive capabilities of contaminants can be destroyed. It is highly effective against virtually all microorganisms, including bacteria, yeasts, molds, and viruses. It is simple to operate, requires no chemicals, and has no effect on the taste or odor of the treated material.

Aquionics' multi-lamp Photon UV systems are being used to disinfect *Listeria*, *E. coli* and other microorganisms online in brine chillers and meat pickle and marinade injectors. The high-tolerance construction and medium pressure UV output function equally well throughout a wide range of temperatures, from super-cooled brines to very hot sanitation cycles. The multi-lamp, high surface area design ensures thorough disinfection of low transmission fluids. Risk of contamination can be greatly reduced while shelf life can be increased. Additionally, in marinade applications, operating costs are reduced through less frequent fluid change-over.

In RTE (ready-to-eat) packaging areas, Aquionics' ARC air systems are being used to disinfect incoming air. Installed within existing ductwork, a single high-powered lamp can disinfect up to 5,000 cubic feet/minute of air. By destroying harmful microorganisms in the heating, ventilation and air conditioning systems, the risk of spoilage and contamination from airborne pathogens is minimized.

The final application of UV in meat processing operations is as a non-chemical treatment for plant wastewater. Increasingly, processors are caught between conflicting sets of regulations. While the FDA is requiring increased use of water to rinse carcasses, etc., environmental regulators are limiting the amount of fresh water that a plant can consume. With only so much fresh water coming in, plants are forced to reduce capacity in order to meet the FDA requirements. By reusing disinfected wastewater in non-contact applications like chillers and cooling towers, more fresh water can be devoted to processing. This low-maintenance technology allows for increased plant production capacity while eliminating hazardous chemicals.

Designed to meet the stringent sanitary requirements of the food industry, the microprocessor controlled UV units can be integrated into plant control systems. Required maintenance is low; typically the UV lamps are replaced once a year by on-site personnel. Automatic internal wiper systems maintain the cleanliness and subsequently the effectiveness of the UV lamps which is especially important in very high solids solutions.

Aquionics, Erlanger, KY

READER SERVICE NO. 284

Key Instruments New Series 8500 Optaflow® Controller Ideal for Wide Range of Liquid and Gas Fluid Control Applications

Key Instruments, a manufacturer of machined acrylic meters, molded polycarbonate, glass tube and electronic flowmeters, optical flow alarms and controllers, as well as flow control valves, has announced the immediate availability of their new Series 8500 Optaflow® Controller for liquid and gas fluid control in R&D,

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laboratory analysis, pilot plant, small batch and quality assurance applications.

Engineered to provide accuracy to +/-3% of full scale standard (+/-1% optional), the Series 8500 Optaflow® Controller combines non-contact optical sensors and electro-mechanical features to set and monitor flow control functions. A tracking mode adjusts the unit's control valve to maintain preset flow parameters and an integrated alarm function provides an audible and visual signal. Real-time flow rate and totalization display, local or remote set-point via 2 alarm set-points, and a fully-functional remote PC interface for multi-unit communication via RS 232/485 are standard.

Liquid models are calibrated for water and contain a manual bleed valve. Gas models offer selectable calibration of six (6) gases: air, O_2, N_2, Ar, CO_2 and HE.

Key Instruments, Trevose, PA

READER SERVICE NO. 285

DuPont Qualicon Helps Increase the Quality and Safety of Food, Pharmaceuticals and Personal Care Products

The experts at DuPont Qualicon use their vast knowledge of molecular methods and mastery of microbiology to give companies innovative diagnostic systems, such as BAX® and RiboPrinter®. These systems have proven to be a powerful part of the quality control and quality assurance processes for major food, pharmaceutical and personal care product companies around the world, providing them with a competitive edge today and well into the future.

The DNA-based BAX® system is a fast, accurate way to detect bacteria in raw ingredients, finished products and environmental samples. This innovative technology reduces false positives and minimizes re-testing. The automated system requires no specialized operator skills and, through the polymerase chain reaction (PCR), can provide results as soon as the next day. The BAX® system delivers clear, reliable "yes-no" answers, virtually eliminating the need for expert interpretation of results. Tableted reagents, which enable minimal hands-on time using standard laboratory techniques, provide long shelf life and consistency.

Seven out of the ten largest food companies use the BAX® system as part of their quality assurance programs. Additionally, the United States Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS) has adopted the BAX® system to detect *Listeria monocytogenes* in the nation's meat and poultry supply and to detect *Salmonella* in the nation's ready-to-eat meat, poultry and pasteurized eggs. FSIS is currently planning to evaluate the BAX® system to detect *Escherichia coli* O157: H7.

DuPont Qualicon also markets the patented RiboPrinter® system, which is the world's only automated DNA fingerprinting instrument that rapidly pinpoints sources of bacteria in pharmaceuticals, personal care products and food. And, the electronic linking of its automated platforms provides microbial information and knowledge networking capabilities for public health agencies, industry, universities and research centers. This enables the sharing of RiboPrint™ patterns, or "universal product codes" for virtually any bacteria, making it faster and easier to help keep people safe in every corner of the world.

DuPont Qualicon, Wilmington, DE

READER SERVICE NO. 286

Span Tech, LLC Offer Flexibility in Turning Radius and Straight Lengths to Fit Almost Any Application

Span Tech, LLC, has introduced the HO-Series Horizontal Offset Conveyor as part of its WhisperTrax™ Modular Flexible Conveyor line. The conveyor has two curves in opposite directions where the entrance and exit straight sections are parallel. The conveyor allows variation in the angle of the curves and in the length of the straight section between the curve and between the curves and the ends of the conveyor. The compound curving nature of the conveyor allows customers to accomplish multiple curves with one conveyor and it's available in both epoxy powder coated paint and stainless steel.

Engineered for dependable, nearly maintenance-free operation and with options to fit almost any application, WhisperTrax™ Modular Flexible Conveyors are ideal for transporting packaged items, assembly work, and applications where users have traditionally used a belt conveyor.

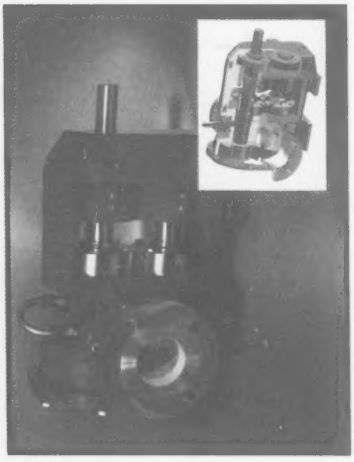
The HO-Series conveyor can be ordered with three different chain types in six chain widths and has a speed range of 5 to 75 feet per minute (1.5 to 22.9 meters per minute), with optional custom speed ranges available. It can handle an increased load carrying capacity over a belt conveyor. WhisperTrax™ Modular Flexible Conveyors also come with the bed section fully assembled, with legs separate for quick assembly.

All seven WhisperTrax™ models feature SpanLon™ acetal plastic chain for long life and virtually silent operation, an important consideration in today's noise-conscious industrial en-

vironments. WhisperTrax™ conveyors generate one-twentieth the amount of noise of a conventional plastic conveyor system.

Span Tech, LLC, Glasgo, KY

READER SERVICE NO. 287



Viking Pump

New Viking Lobe Pumps Address Special Requirements of Industrial Applications

Viking Pump's new line of Industrial Lobe Pumps is specially designed to meet industrial application requirements for chemicals, paper coatings, textile dyes, automotive paints, resins and coatings, latex, polymers, sugars, starches, cellulose acetate and more. This new pump series is available in both 2-bushing models, with pressure range of up to 225 psi, and 4-bushing designs, which feature shaft support on both sides of the rotors to provide up to 400 psi. With capacities up to 820 gpm, the bi-wing rotor design ensures high volumetric efficiency and provides solids handling capability, yet maintains the product integrity of shear-sensitive fluids.

Outstanding sealing flexibility allows these pumps to accept packing, component mechanical seals, cartridge-style single and double mechanical seals and lip seals from major manufacturers like John Crane, FlowServe, Garlock and others. The 1.875" and 3" seal sizes are readily available and seals may be installed from either the lobe end or the drive end of the pump.

Viking Industrial Lobe Pumps have a rugged stainless steel design. They are easy to maintain, with simplified timing and rotary end clearance adjustments without shims. They also provide flexibility in the ports with enlarged suction areas, and the ability to reverse the direction of flow.

Viking Pump, Cedar Falls, IA

READER SERVICE NO. 288

A-T Controls High Cycling Solution, New TRIAC TR Series Pneumatic Valve Actuators Provide Superior Reliability and Application Versatility

Engineered for highest cycle life, new TRIAC TR Series pneumatic valve actuators from A-T Controls Inc. provide superior reliability, return on investment and application versatility for line automation.

Delivering million-cycle dependability in high-cycling operations, the new TR Series actuators come standard with dual travel stops, wide base with ISO5211 mounting, and serialization for traceability. Particularly suited to butterfly valves, ball valves and damper applications, the TR Series actuators are available in 11 sizes with torques to 36,000 in. lbs. for precise compatibility.

The actuators feature robust rack-and-pinion operation with substantial pinion bearings delivering high cycle life. The TRIAC units provide 100° of rotation, with range of closure adjustable by dual travel stop screws. The TR Series actuators come in both double-acting and spring-return models rated for standard working temperatures of -20°F to 175°F, with lower and higher temp units available as options.

Furthering application flexibility, the actuators provide Namur accessory mounting configuration and can be accessorized by A-T Controls to virtually any control requirement, as well as assembled and mounted onto customer-specified valves.

Wide-base design with direct-mount ISO5211 automation pad enables simple installation of TR Series actuators to many butterfly and ball valves.

Air supply requirements range from 40 to 150 psi. Besides compressed air, the actuators accept non-corrosive gas or light hydraulic oil as operating medium. Hard anodized finish on the actuator housing resists corrosion.

A-T Controls Inc., Cincinnati, OH

READER SERVICE NO. 289

Eriez Magnetics Improved Drawer Grate Magnet for Chute and Hopper Applications

Eriez has redesigned its Drawer and Wing Grate Magnet to improve operation and separation performance. These new drawer units, using Eriez' Ceramic or Erium® 3000 Rare Earth magnetic tubes, provide a powerful and economical solution to coarse scalping of nuts and bolts or removing fine metal containment from free-flowing product applications.

Built using only stainless steel components with a thicker door and continuously welded frame and tube assemblies, the new drawer is more rigid and easily integrates into existing hopper and chute systems. The optional deflector grid improves product purity by directing the flow over

the magnetic surface. Eriez Wing and Drawer Grate Magnets are also available in staggered, two-tier designs to provide the highest level of product purity.

Eriez Magnetics, Erie, PA

READER SERVICE NO. 290

Anderol, ConocoPhillips Strengthen Relationship to Provide Food Processors with H1 and H2 Lubricants

Anderol, a supplier of synthetic lubricants, and the Commercial Lubricants Division of ConocoPhillips Company, solidified their industry relationship by combining their H1 "incidental contact" and H2 "no contact" food grade lubricant offerings. The goal of the alliance is to help food manufacturers in the United States, Australia and Singapore meet worldwide safety standards, increase productivity and better protect brand integrity by using the proper food grade lubricants to support their processing applications. Anderol will market its branded synthetic and PQ(r) white-oil-based lubricants and provide technical expertise, positioning ConocoPhillips as the pivotal distribution, sales and support partner. Dual efforts benefit food processors through extended product expertise, enhanced service and reduced total systems costs.

The alliance meshes Anderol's synthetic and PQ(r) white-oil based food grade lubricants with ConocoPhillips' H2 line of ConocoPhillips 66 and 76 lubricants brand strengthening the ability to serve corporate accounts throughout all segments of the food and beverage industry. Specifically, Anderol will focus on generating product awareness within the snackfood, baking, fresh cut, meat, poultry and beverage segments through ConocoPhillips' distribution channels in the United States, Australia and Singapore. Food processors in these regions will find the Anderol's high-performing H1 lubricants are comparable in performance to non-food grade, premium lubricants, keeping equipment operating efficiently with extended life cycles while protecting product safety, quality, and value. All Anderol lubricants meet Kosher for Pareve, and Halal specifications. Moreover, customers will have access to the expert resources of the company's professional research and development and technical service team for customized lubricants, oil monitoring and quick, accurate response to inquiries.

Anderol, East Hanover, NJ

READER SERVICE NO. 291

WANTED:

The editors are seeking articles of general interest and applied research with an emphasis on food safety for publication in *Food Protection Trends.*

Submit your articles to:

Donna Bahun, Production Editor
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International Association for Food Protection
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COMING EVENTS

SEPTEMBER

- **3-5, Georgia Association for Food Protection Annual Fall Meeting,** Clarion Resort Buccaneer, Jekyll Island, GA. For more information, call Robert Brooks at 770.536.5909.
- **4, HACCP: A Management Summary,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **7-12, International Meeting on Radiation Processing (IMRP) 2003,** Chicago, IL. For more information, contact Patty Brewer at 814.870.8483.
- **8-9, Quality Improvement Associate,** GFTC, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.
- **9-10, Beginning Laboratory Methods in Food Microbiology,** South Holland, IL. For more information, call Silliker at 800.829.7879.
- **10-14, International Food, Drink and Technology Exhibition,** National Expocenter of Ukraine, Kiev. For more information, contact Ken Cardelle at 203.357.1400; E-mail: Kcardelle@iegexpo.com.
- **15-16, HACCP I: Documenting Your HACCP Prerequisites,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **16-17, Upper Midwest Dairy Industry Association Annual Meeting,** Holiday Inn, St. Cloud, MN. For more information, contact Paul Nierman at 763.785.0484.
- **16-18, Intermediate Laboratory Methods in Food Microbiology,** South Holland, IL. For more information, call Silliker at 800.829.7879.
- **16-18, New York State Association for Food Protection Annual Meeting,** Sheraton Inn, Saratoga Springs, NY. For more information, call Janene Lucia at 607.255.2892.
- **17-18, Wisconsin Association for Food Protection Joint Education Conference,** Holiday Inn, Fond du Lac, WI. For more information, contact Randy Daggs at 608.837.2087.
- **17-19, HACCP II: Developing Your HACCP Plan,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **21-24, The Western Association of Food and Drug Officials 2003 Educational Conference,** Silver Legacy Resort, Reno, NV. For more information, call 800.687.8733.
- **22-24, Indiana Environmental Health Association Annual Fall Meeting,** Holidome, Jasper, IN. For more information, contact Helene Uhlman at 219.853.6358.
- **22-24, Kansas Association of Sanitarians Annual Fall Meeting,** New Sheridan Hotel, Olathe, KS. For more information, contact Tim Wagner at 800.527.2633.
- **23-24, Auditing Fundamentals,** Oak Brook, IL. For more information, call Silliker at 800.829.7879.
- **24, Wyoming Environmental Health Association Annual Fall Meeting,** Holiday Inn, Cheyenne, WY. For more information, contact Bryan Grapes at 307.532.4208.
- **29-Oct. 1, Canadian Institute of Public Health Inspectors (CIPHI) Ontario Branch 64th Annual Educational Conference,** Waterloo Inn and Conference Centre, Waterloo, Ontario, Canada. For more information, contact Ken Diplock at 519.883.2008 ext. 5435; E-mail: dken@region.waterloo.on.ca.
- **30-Oct. 2, Washington Association for Food Protection Annual Meeting,** Campbells Resort, Chelan, WY. For more information, contact Bill Brewer at 206.363.5411.
- **30-Oct. 3, Better Process Control School,** University of Nebraska, Lincoln, NE. For general information, contact Pauline Galloway at 402.472.9751; E-mail: pgalloway2@unl.edu.

OCTOBER

- **1-4, The 5th International Symposium on the Epidemiology and Control of Foodborne Pathogens in Pork,** Creta Maris Hotel, Hersonissos, Heraklion, Crete, Greece. For more information, call 30.210.749.93.00; E-mail: congress@triaenatours.gr.
- **2, American Association of Cereal Chemists 88th Annual Meeting,** Portland, OR. For more information, contact Kathryn Aro at 651.454.7250; E-mail: karo@scisoc.org.
- **2-3, FSIS Verification of HACCP Plans–A Meat and Poultry Industry Workshop,** Omaha, NE. For more information, call 202.393.0890; E-mail: fpi@nfpa-food.org.
- **2-3, IDV and CSO for Meat and Poultry Industry,** Omaha, NE. For more information, call Food Processors Institute at 202.393.0890.
- **6-10, Dairy Technology Workshop** Randolph Associates, Inc., Nashville, TN. For more information, call 205.595.6455; E-mail: us@randolphconsulting.com.
- **7-8, Associated Illinois Milk, Food and Environmental Sanitarians Annual Fall Meeting,** Stoney Creek Hotel, Peoria, IL. For more information, contact John Ellingson at 815.490.5523.
- **8-11, Second International Symposium on Sourdough,** Brussels, Belgium. For more information, call 32.16.204035; E-mail: aacc@scisoc-europe.org.
- **9, Rapid Microbial Methods,** Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: minglis@gftc.ca.
- **14, SQF Systems Awareness Training,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **14-16, Food Security Coordinator Workshop,** Toronto, Canada. For

IAFP UPCOMING MEETINGS

AUGUST 8-11, 2004
Phoenix, Arizona

AUGUST 14-17, 2005
Baltimore, Maryland

AUGUST 13-16, 2006
Calgary, Alberta, Canada

more information, call AIB at 785.537.4750.

- **15-16, Food Allergens: Issues and Solutions for the Food Product Manufacturer,** Hotel Sofitel, O'Hare, Chicago, IL. For more information, contact Pauline Galloway at 402. 472.9751; E-mail: pgalloway2@unl.edu.
- **19-22, University of Wisconsin-River Falls 23rd Annual Food Microbiology Symposium,** (Current Concepts in Foodborne Pathogens and Rapid and Automated Methods in Food Microbology), University of Wisconsin-River Falls. For more information, contact the University of Wisconsin-River Falls Animal and Food Science Dept. at 715.425.3704; E-mail: foodmicro@uwrf. edu.
- **20-22, Thermal Process Development,** Dublin, CA. For more information, call Food Processors Institute at 202.393.0890.
- **22, Metropolitan Association for Food Protection Annual Spring Meeting,** Rutgers, Cook College, New Brunswick, NJ. For more information, contact Carol Schwar at 908.689.6693.
- **23-24, Thermal Process Development,** Dublin, CA. For more information, call Food Processors Institute at 800.355.0983.
- **27-28, HACCP IV: Validation and Verification of Your HACCP Plan,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **28-30, Applied Extrusion,** University of Nebraska Food Processing Center, Lincoln, NE. For more information, contact Pauline Galloway at 402. 472.9751; E-mail: pgalloway2@unl.edu.
- **28-30, North Dakota Environmental Health Association Annual Fall Meeting,** Spirit Lake Resort, Devil's Lake, ND. For more information, contact Debra Larson at 701.328.6150.
- **29-30, HACCP V: Effective Auditing of Your HACCP Plan,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.
- **29-30, Iowa Association for Food Protection Annual Fall Meeting,** Ames, IA. For more information, contact Phyllis Borer at 712.754.2511, ext. 33.
- **29-31, HACCP for Juice Processors,** Miami, FL. For more information, call Food Processors Institute at 202.393.0890.
- **29-Nov. 1, Worldwide Food Expo,** McCormick Place, Chicago, IL. For general information, contact Pamela Morrison at 202.220.3532 or go to www. wwfe@idfa.org.

NOVEMBER

- **4-6, Food Security Coordinator Workshop,** Sacramento, CA. For more information, call AIB at 785. 537.4750.
- **8-9, Mexico Association for Food Protection Annual Fall Meeting,** Mission Carlton Hotel, Guadalajara, Jal., Mexico. For more information, contact Alex Castillo at 979.845.3565.
- **17-21, Brazil Association for Food Protection Annual Meeting,** Centro-Sul Convention Center, Florianopolis, Santa Catarina State, Brazil. For more information, contact Maria Teresa Destro at 55.11.3091. 2199.
- **19, Alabama Association for Food Protection Annual Fall Meeting,** Holiday Inn, Homewood, AL. For more information, contact G. M. Gallaspy at 334.206.5375.
- **20, Ontario Food Protection Association Annual Fall Meeting,** Mississauga Convention Centre, Mississauga, Ontario, Canada. For more information, contact Glenna Haller at 519.823.8015.
- **27-28, SQF 1000/2000^{CM} Systems Training,** GFTC, Guelph, Ontario, Canada. For more information, call 519.821.1246; E-mail: gftc@gftc.ca.

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received a call from one of the processors who proudly announced that thanks to Dr. David and Dr. Ken and the program we offered, they had reduced the number of CCPs in their HACCP program from 25 to five, resulting in a more efficient and less costly program.

A HACCP plan can have no critical control points.

This is a tough one, but I believe that the answer is true. If a processor does a proper hazard analysis, identifies potential hazards, and is able to address those hazards through prerequisite programs, what is the operator doing? He has applied the principles and is assuring safety. Are there examples of such operations? How about a repacking operation for frozen IQF shrimp in which a product is simply transferred from one package to another? And there are undoubtedly other examples. The bottom line is that if a processor educates its staff, forms a HACCP team, and follows the remaining preliminary steps, and then does a hazard analysis which shows that all potential hazards are unlikely to occur even in the absence of control, or may be controlled by use of prerequisite programs, how do you classify such a program? Of course, part of the hazard analysis process is to examine means of reducing or eliminating a hazard. For example, if a processor identifies wood as a potential hazard, switching from wood to plastic pallets could, depending upon the operation, eliminate the hazard completely.

HACCP plans are to be developed by processors, as they know and understand their operations better than anyone else.

True. This is one of the basic tenets of HACCP and was emphasized in the 1985 National Academy of Sciences report. Nobody knows more about a processing operation than the processor, so it makes perfect sense that the processor develop the HACCP plan. If a processor develops a HACCP plan and it has been shown to be effective, shouldn't that be the "proof of the pudding," so to speak? Although it would seem so, that is not quite the way things are evolving in this country, at least in certain industries. Both the FDA and USDA have determined that they have a role in determining what should and should not be a critical control point. For example, in its April 24, 2003 guidance document for the juice processing industry, FDA has mandated that "*The producer and user designate as a Critical Control Point (CCP) in their respective HACCP plans, the bulk transport of covered products from the production facility to a separate facility for further processing and final packaging.*" A large number of meat processors are also being told by FSIS officials that their HACCP plans need to be revised, or else. The depressing aspect of actions such as this by the FSIS is that they often ignore the fact that the program has been operating successfully for an extended period and that there is historical data to support the efficacy of the current program. However, it would be wrong to flog the regulators alone. The food industry has mandated that many of its suppliers establish metal detection as a CCP even if the company has conducted a hazard analysis and determined that metal either is not a hazard or can be controlled in another way.

Once the HACCP plan has been developed and has been implemented, your work has only begun.

True. A HACCP plan is a living and evolving system, thanks in large part to Principle 6, Verification. The team needs to schedule regular meetings to evaluate system performance, examine how changes in ingredients or processes affect the program, validate critical control point limits, and examine how new science or learning may affect the safety of their products and processes. If one ever finds a HACCP manual in a plant that must have the dust blown off it, it is a pretty good clue that the operation does not have a viable and evolutionary HACCP program.

All HACCP plans must be certified.

False. This question was developed while I was working overseas, as in other places, where the food industry was infatuated with certification. There may be two different issues that are causing this to happen: (1) In some areas of the world, there is a lack of trust that the government food regulatory agencies are doing an adequate job of ensuring the safe production of food; (2) Even in areas of the world where regulatory agencies are doing an outstanding job, food regulations are minimum standards. Therefore, the intermediary customer may want a food safety system that exceeds the minimum requirements. They may achieve this goal by requiring the food processor to develop a system that exceeds the regulatory requirements, and require the food processor to demonstrate compliance to customer requirements by achieving third-party certification. Unfortunately, many food processors want certificates for everything, ISO, HACCP, etc., but rather than treat certification as a means of enhancing safety or quality, most operators looked at these programs as documentation programs only. HACCP certification is an interesting concept, however, especially since there seems to be a demand for the service. A number of organizations, both private and public, around the world will evaluate and certify HACCP programs. There is one slight problem, however: There is no recognized international standard against which a program may be certified. Granted, there are the Codex Texts on Food Hygiene and the National Advisory Committee for Microbiological Criteria for Foods, which include HACCP guidelines, but they are not standards. To address what seems to be a demand for certification, the ISO has authorized a Technical Committee whose goal is to create a food safety management system standard that incorporates basic HACCP principles. The standard is currently in the development phase and will incorporate basic HACCP principles and prerequisite programs or Supportive Safety Measures. Will ISO-certified HACCP programs be a good thing? Only the Swami can answer that.

There is one other slight problem with certification. Government agencies around the world have also moved to create national food safety standards. By doing so, these agencies place themselves in what could be called an untenable position. They have created the standards, they manage the standards, and they also end up certifying programs.

These questions not only set the stage for a workshop and gave the instructor (me) a feeling for the students in the program, they also provided a forum for discussion. I hope that they will continue to do so.

CAREER SERVICES

Supervisory Microbiologist

The USDA/ARS, Poultry Microbiological Safety Research Unit in Athens, GA is seeking a Research Microbiologist GS-14/15 ($79,344-$93,330), salary commensurate with experience. Incumbent conducts personal research and provides leadership to basic and applied research to develop knowledge and technologies that will support other State and Federal agencies and the poultry industry by preventing or controlling the presence of human bacterial pathogens in fertile broiler/breeder eggs, on-farm chickens, and spent litter for distribution onto agricultural lands. The three program areas for this unit are (1) controlling colonization of poultry by *Campylobacter*, (2) controlling colonization by *Salmonella* and *Clostridium perfringens*, and (3) assessing and controlling pathogens in poultry manures. As Research Leader, incumbent is responsible for managing the Unit physical, personnel, and financial resources in application to project objectives. Incumbent also serves as Coordinator of Poultry Food Safety Research at the Athens, GA location. United States citizenship is required. Comprehensive benefits package included. For information on the research program/position, contact Mrs. Donna Line at 706-546-3531 or Dline@saa.ars.usda.gov. For the full text of the vacancy announce, which includes application materials and forms, contact Genell Powers at 706-546-3029, or visit the ARS vacancy website at http://www.afm.ars.usda.gov/divisions/hrd/index.html. Announcement number ARS-X3S-3221. Applications must be postmarked by September 15, 2003. USDA-ARS is an Equal Opportunity Provider and Employer.

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Official Publication

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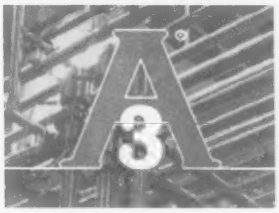

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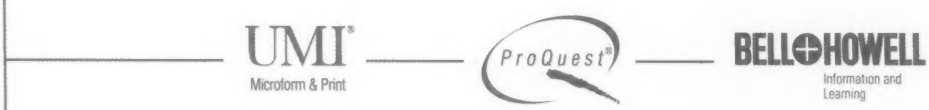

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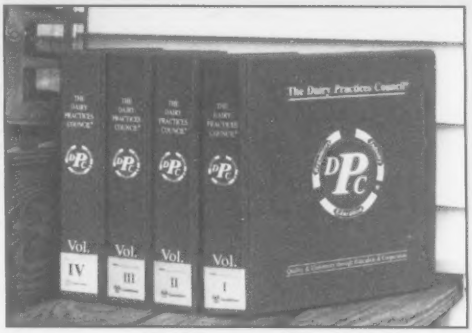

IAFP Offers "Guidelines for the Dairy Industry" from The Dairy Practices Council®

This newly expanded Four-volume set consists of 70 guidelines.

1 Planning Dairy Freestall Barns
2 Effective Installation, Cleaning, and Sanitizing of Milking Systems
3 Selected Personnel in Milk Sanitation
4 Installation, Cleaning, & Sanitizing of Large Parlor Milking Systems
5 Directory of Dairy Farm Building & Milking System Resource People
6 Natural Ventilation for Dairy Tie Stall Barns
7 Sampling Fluid Milk
8 Good Manufacturing Practices for Dairy Processing Plants
9 Fundamentals of Cleaning & Sanitizing Farm Milk Handling Equipment
10 Maintaining & Testing Fluid Milk Shelf-Life
11 Sediment Testing & Producing Clean Milk
12 Tunnel Ventilation for Dairy Tie Stall Barns
13 Environmental Air Control and Quality for Dairy Food Plants
14 Clean Room Technology
15 Milking Center Wastewater
16 Handling Dairy Products from Processing to Consumption
17 Prevention of & Testing for Added Water in Milk
18 Fieldperson's Guide to High Somatic Cell Counts
21 Raw Milk Quality Tests
22 Control of Antibacterial Drugs & Growth Inhibitors in Milk and Milk Products
23 Preventing Rancid Flavors in Milk
24 Troubleshooting High Bacteria Counts of Raw Milk
25 Cleaning & Sanitation Responsibilities for Bulk Pickup & Transport Tankers
27 Dairy Manure Management From Barn to Storage
28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment
29 Cleaning & Sanitizing in Fluid Milk Processing Plants
30 Potable Water on Dairy Farms
31 Composition & Nutritive Value of Dairy Products
32 Fat Test Variations in Raw Milk
33 Brucellosis & Some Other Milkborne Diseases
34 Butterfat Determinations of Various Dairy Products
35 Dairy Plant Waste Management
36 Dairy Farm Inspection
37 Planning Dairy Stall Barns
38 Preventing Off-Flavors in Milk
39 Grade A Fluid Milk Plant Inspection
40 Controlling Fluid Milk Volume and Fat Losses
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43 Farm Tank Calibrating and Checking
45 Gravity Flow Gutters for Manure Removal in Milking Barns
46 Dairy Odor Management
48 Cooling Milk on the Farm
49 Pre- & Postmilking Teat Disinfectants
50 Farm Bulk Milk Collection Procedures
51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components
53 Vitamin Fortification of Fluid Milk Products
54 Selection of Elevated Milking Parlors
54S Construction Materials for Milking Parlors
56 Dairy Product Safety (Pathogenic Bacteria) for Fluid Milk and Frozen Dessert Plants
57 Dairy Plant Sanitation
58 Sizing Dairy Farm Water Heater Systems
59 Production and Regulation of Quality Dairy Goat Milk
60 Trouble Shooting Microbial Defects: Product Line Sampling & Hygiene Monitoring
61 Frozen Dessert Processing
62 Resources For Dairy Equipment Construction Evaluation
63 Controlling The Quality And Use Of Dairy Product Rework
64 Control Points for Good Management Practices on Dairy Farms
65 Installing & Operating Milk Precoolers Properly on Dairy Farms
66 Planning A Dairy Complex - "100+ Questions To Ask"
69 Abnormal Milk - Risk Reduction and HACCP
71 Farmers Guide To Somatic Cell Counts In Sheep
72 Farmers Guide To Somatic Cell Counts In Goats
73 Layout of Dairy Milk Houses for Small Ruminant Operations
78 Biosecurity for Sheep and Goat Dairies
80 Food Allergen Awareness In Dairy Plant Operations
83 Bottling Water in Fluid Milk Plants
100 Food Safety in Farmstead Cheesemaking
103 Approving Milk and Milk Product Plants for Extended Runs

IAFP has agreed with The Dairy Practices Council to distribute their guidelines. DPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout the United States. In addition, its membership roster lists individuals and organizations throughout the world.

For the past 34 years, DPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality milk and milk products.

The DPC Guidelines are written by professionals who comprise six permanent task forces. Prior to distribution, every guideline is submitted for approval to the state regulatory agencies in each member state. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

The guidelines are renown for their common sense and useful approach to proper and improved sanitation practices. We think they will be a valuable addition to your professional reference library.

If purchased individually, the entire set would cost $327. We are offering the set, packaged in four looseleaf binders for $245.00.

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	*Developing HACCP Plans–A Five-Part Series (as published in *DFES*)	15.00	15.00	
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THOUGHTS *On Today's Food Safety*

HACCP Myths and Misunderstandings

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I feel that it is important, whenever I teach a HACCP workshop, to try to ascertain how much the students really understand about HACCP and the principles that make up the program. Perceptions differ among individuals, and especially between people working in different areas, that is, academics, government employees and those from industry. These differences are even more pronounced when working and teaching outside of North America. To determine students' knowledge of the program and its goals, I pose a series of "True/False" questions to the participants that address some of the basics. The questions may seem far too elementary, but it is surprising how many people do not grasp the basic concepts.

All foods manufactured under a HACCP system are absolutely safe.

False. HACCP does not assure absolute safety. It is, however, the best available management system that we have for approaching that goal. This is one area where the food industry, academia and government could do much better when it comes to public relations and both consumer and media education. I am personally getting rather tired of seeing what could be construed as snide comments in the mainstream press about the failures of HACCP as a food safety system. HACCP itself is not the cause of food safety incidents that originate from companies that have adopted HACCP. These problems are usually caused by individuals failing to follow either the HACCP plan or the prerequisite program. The low-acid canned food regulations are based on HACCP principles and have functioned quite well for over thirty years, so we already know that the system works. Please, as an industry, let's make a concerted effort to explain in simple terms, with easy-to-grasp examples, why process control and not testing is the key to a safe food supply.

HACCP is a stand-alone system. You don't need anything else but HACCP.

False. HACCP cannot stand alone. Industry and government seem to have come to an understanding that HACCP without basic prerequisite programs cannot assure safe foods. This concept has obviously been accepted throughout the world, also, as evidenced by the inclusion of Supportive Safety Measures (SSMs), in the International Organization for Standards (ISOs) draft food safety management system standard; SSM is simply another term for prerequisite programs. These programs create the proper environment for production of safe food and the environment for HACCP to work. What we need to do as food safety professionals is to emphasize to processors who would like to implement HACCP in their operations that they need to develop and implement the necessary prerequisite programs first. In fact, I have encouraged processors to not even think about starting HACCP until such programs have been developed. This can be a real battle, as I learned in my overseas work. HACCP is a buzz word, perceived as sort of a "sexy" thing to have by many processors, whereas basics such as handwashing, cleaning and sanitizing, pest management, and tracking and recall programs seem awfully mundane. I mean, when someone in a plant environment tells you he wants to implement HACCP, yet his facility has no screens on the windows, there is an open sewer running alongside the plant, and one is constantly swatting at flies, you have a real case of someone "unclear on the concept."

The more critical control points, the better your HACCP plan.

False. Most people and operators with whom I have worked and talked seem to grasp the importance of establishing only as many CCPs as are necessary to control realistic hazards. I say most, as there are still operators who are bound and determined to have twenty or more CCPs in their plans. Earlier this year, I attended the NFPA-SAFE auditors program and had an opportunity to talk with people from Europe, Australia and New Zealand. More than one person told me that they knew processors who had programs with 20 or more CCPs. One of the more pleasant results of my work in Egypt between 1999 and 2001 was the enhanced food safety awareness created by the Technical Services Group that Mr. Morad Ahmed and I managed. As part of the four-part HACCP series of workshops we developed and/or offered, we were fortunate enough to be able to get Drs. Ken Stevenson and David Gombas over to teach the "Verification and Validation" program they helped develop. Two weeks after one of these classes, we

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Invite a Colleague to Join

The International Association for Food Protection, founded in 1911, is a non-profit educational association of over 3,000 food safety professionals with a mission ***"to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."*** Members belong to all facets of the food protection arena, including Industry, Government and Academia.

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